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JOURNAL

OF THE

FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA,

FOR THE PROMOTION OF THE MECHANIC ARTS.

DEVOTED TO

MECHANICAL AND PHYSICAL SCIENCE,

Civil Engineering, the Arts and Manufactures,

AND THE RECORDING OF

AMERICAN AND OTHER PATENT INVENTIONS.

EDITED BY

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FOR THE

PROMOTION OF THE MECHANIC ARTS.

JULY, 1856.

CIVIL ENGINEERING.

*Dr. Boucherie's Patent Process for Preserving Wood from Decay.**

[Extracted from the Report of the Jury of the French Exposition, and other Official documents]

This patent is for an important improvement in the process of preparing timber, so as to preserve it from decay.

It is the invention of the eminent French chemist, Dr. Boucherie, who has devoted nearly twenty years in bringing it to perfection.

The system of Dr. Boucherie accomplishes two objects:—first, that of expelling the sap; and, secondly, filling the pores of the timber with a preservative solution.†

The manner in which this is effected is by applying the preserving fluid under pressure, so as to cause it to pass longitudinally along the fibres. The preserving fluid thus forces the sap out before it, and occupies its place.

The advantages which would result from expelling the sap, and replacing it with an antiseptic fluid, have been long known, and the idea of effecting it by applying the fluid under pressure at the end of a piece of timber is not new, having been suggested and patented many years ago by Mr. Bethel. But the means then used did not accomplish the object in such a manner as to admit of its commercial application.

Hence the more expensive process of creosoting has been adopted—where the timber is totally immersed in the oil under pressure—which does not permit the sap to escape.

Dr. Boucherie's process has been attended with complete success.

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* From Herapath's Journal, No. 881, April 26, 1856.

† See Journal of the Franklin Institute, Third Series, Vol. II, p. 99; XI, pp. 142 and 314.

The apparatus employed, is of a very inexpensive character, and may be erected in a few days; it is capable of application on the most extended scale; and it is, in fact, very extensively employed at this time in preparing sleepers and telegraph posts for the French railways.

When the timber is under operation, the sap runs out from the ends in a clear stream, showing the amazing quantity of this fluid which is contained, and exhibiting the tubular structure of the wood, in the most striking manner; in fact, the preserving fluid will traverse a tree, twelve feet in length, with less pressure than is required to force it laterly through a plank three-quarters of an inch in thickness. When the sap is forced out the preservative fluid follows it, and its presence at the ends of the wood is ascertained by a chemical test.

Thus the sap and fermenting juices become completely expelled, and the timber becomes saturated throughout its length with the preserving fluid.

Important advantages arise in the employment of this process in this country. First, it may be applied successfully to Scotch fir, beech, elm, and other home-grown timber; secondly, it is not necessary that the wood should be dried or seasoned before being prepared, but, on the contrary, the operation is best effected within a few weeks after the tree has been cut down; thirdly, any cheap antiseptic fluids, such as solutions of sulphate of copper, or chloride of zinc, become perfect preservatives when applied in this manner; and, fourthly, no heat is required, and the wood is not rendered inflammable.

The result is a saving in first cost of about one shilling per sleeper as compared with Baltic timber creosoted; while the durability thus attained has been fully ascertained by the extensive trials already made in France, which will be further described.

Success of the System in France.—The first report upon this process was made in the year 1841, by a committee of the French Academy of Science, M. Arago being chairman, upon the occasion of a pamphlet on the subject by Dr. Boucherie being read before that distinguished body, and which was consequently ordered to be inserted in the "*Recueil des Savants Etrangers*," and copies to be forwarded to the Ministers of Agriculture, Commerce, Public Works, Marine, Finance, and War.

In the year 1850, the French government appointed a commission of distinguished engineers of the Ponts et Chaussées, and again in 1852, the principal officers of Genise, to minutely investigate and report upon the merits of this invention, and which they accordingly did; the reports on both occasions, being favorable to Dr. Boucherie's invention; while, at the close of the recent Exposition, the French government marked its sense of the public benefit derivable from it by awarding to its inventor, the rare distinction of the large gold medal of honor, of which there were only four conferred on the representatives of the whole of France.

Duration of Sleepers prepared by this Process.—In the year 1846, 80,000 sleepers thus prepared, were authorized to be laid down upon the Northern Railway of France, together with a certain quantity of unprepared sleepers.

In this instance, the Company chose wood that decays easily, and which, on that account, had been rejected for durable works. They employed beech, pine, alder, elm, and birch.

These sleepers were inspected every year, and each time were found in a perfect state of preservation. In May, 1855, Dr. Boucherie being desirous of exhibiting in the Exposition some wood prepared by this process, had a few of each kind of these sleepers taken up, and they were found in every instance to be in as perfect a state as when first laid down; the bark was unaltered, exhibiting two letters, the initial mark of the contractor, as clear and visible as when first impressed, while those sleepers which had been laid down unprepared had long since been reduced to decay. Upon these results being established, the greatest French Railway Companies, such as the Northern, Eastern, Nantes, &c., came forward, and required the immediate application of this process to the timber used upon their lines.

The following is an extract of a report upon the subject addressed to the jury of the late Exposition, by the administrators of the Northern Railway of France:—

"The sleepers prepared by Dr. Boucherie's process are preserved in an absolute manner, it being impossible to foresee a limit to their duration, seeing the present perfect state of preservation exhibited by those sleepers laid down eight years ago. The Northern Railway Company has adopted this process in preference to all others.

"Since the year 1853, the Northern Company has ordered more than 300,000 sleepers prepared by this system, and further orders would have been given, if they had found contractors disposed to deliver upon the same terms; however, at the present time tenders are required for more than 200,000 of those sleepers."—September, 1853.

Telegraph Posts.—The principle, as applied to the use of telegraphic posts, has been attended with equally favorable results, both as regards durability and economy. In the year 1846, the French Government substituted white pine posts prepared by this process, for the usual oak posts, for telegraphic wires on the Rouen line, and they are at the present time in as perfect a condition as when first erected.

This proves, and it is of importance to know, that timber thus prepared is equally efficacious when buried in dry or damp earth, and this is also exemplified daily by the telegraphic posts placed all over the French territory. Mr. Alexander, inspector of telegraphic lines in France, officially reported the costs of the two kinds of posts employed on that line as follows:—

Prepared pine telegraph posts.	Feet.		Unprepared oak telegraph posts.
Ordinary posts	5½ (4s. 5d.)	against	16fr. (12s. 9d.)
Winding posts	9 (7s. 3d.)	"	40fr. (£1 12s.)
Crossing posts	16 (12s. 0d.)	"	70fr. (£2 16s.)

The following letter on the subject is from the administration of telegraphic lines in France:—

"*Paris*, *August* 14, 1855.

"Sir,—All the telegraph posts in the French empire have been prepared by your process.

"The administration had 200,000 on the 1st of January last, and since that time have caused 32,000 additional posts to be prepared.

"The preservation of the posts thus injected with sulphate of copper is rendered complete, although the first were prepared and laid down in the year 1846.

"It is with pleasure, doctor, that I am enabled to give you this information, in order that you may communicate it to the members of the jury of the Universal Exposition.

(Signed,) "H. DE VOUGY,
"Chief Administrator of Telegraphic Lines,
"Minister of the Interior."

"To Dr. BOUCHERIE."

The Resistance of Flexure: On the existence of an element of Strength in Beams subjected to Transverse Strain, arising from the Lateral Action of the fibres or particles on each other.[*] By WILLIAM HENRY BARLOW, F. R. S.

It has long been known, that under the existing theory of beams, which recognises only two elements of strength, namely, the resistances to direct compression and extension, the strength of a bar of cast iron subjected to transverse strain cannot be reconciled with the results obtained from experiments on direct tension, if the neutral axis is in the centre of the bar.

The experiments made both on the transverse and on the direct tensile strength of this material have been so numerous and so carefully conducted, as to admit of no doubt of their accuracy; and it results from them, either that the neutral axis must be at, or above, the top of the beam, or there must be some other cause for the strength exhibited by the beam when subjected to transverse strain.

In entering upon this question, it became necessary to establish clearly the position of the neutral axis, and the following experiments were commenced with that object; but they have led to others which are also described herein, and which establish the existence of a third, and a very important element of strength in beams.

I was desirous that the experiments for determining the position of the neutral axis should be made on such a scale and in such a manner as to place this question beyond doubt; and with this object the following means were adopted:—

Two beams were cast, 7 feet long, 6 inches deep, and two inches in thickness; on each of which were cast small vertical ribs at intervals of 12 inches: these ribs were one-fourth of an inch wide, and projected one-fourth of an inch from the beam. In each rib nine small holes were drilled to the depth of the surface of the beam, for the purpose of inserting pins attached to a delicate measuring instrument; the intention being to ascertain the position of the neutral axis by measuring the distance of the holes in the vertical ribs when the beam was placed under different strains. The measuring instrument consisted of a bar of box-wood, in which was firmly inserted, at one end, a piece of brass, carrying a steel pin; and at the other end a similar piece of brass carrying the socket of an adjusting screw. The adjusting screw moved a brass slide, which carried another pin similar to that inserted in the box-wood bar, at the other end of the instrument. The instrument was first made entirely of brass; but the effects of expansion from the heat of the hand were so sensible, that the wooden bar was substituted. The pins on the instrument fitted loosely into holes in the beam; and the mode of using the instrument was, to bring the pins up by means of the screw against the side of the holes with a certain degree of pressure, which, with a little practice in using the instrument, was attained with considerable accuracy.

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[*] From the Lond. Civ. Eng. and Arch. Jour., Jan., 1856.

Two beams were employed in order to avoid errors which might arise from accidental irregularities in the metal. The head of the adjusting screw was graduated to 100 divisions, and the screw had 43·9 threads to the inch, so that one division was equal to $\frac{1}{4390}$ of an inch.

The measurements were, in all cases, taken by the outsides of the pins of the measuring instrument; and when the instrument read zero, the actual distance of the outer sides of the two pins was $\frac{51661}{4390}$ inch, so that the constant number 51661 being added to the micrometer readings gives, in each case, the total distance in terms of $\frac{1}{4390}$ of an inch.

The measurements were taken four times in each position of the beam, and the error of measurement did not generally exceed from one to two divisions; but if in the four observations an error amounting to more than four was found, it was corrected by remeasurement.

The numbers given in the following tables are the micrometer readings, and the *means* of four observations in each case. In these experiments more than 3000 measurements were taken; but to avoid unnecessary figures, only the more prominent results are given.

Table No. I. contains the measurements of the centre division of the first beam under eight different conditions.

Table No. II. contains similar measurements of the second beam.

In the first experiment it was found that, when the beam was inverted, the measuring instrument appeared to bear upon a different part of the holes, so that a direct comparison between the distances, in the beam erect and inverted, cannot be made with the same accuracy as the comparisons of different strains upon the beam when in the same position. The first beam had been subjected to strain for the purpose of testing the measuring instrument previous to these experiments being made; but the second beam had not; and it will be seen that the effect of the strains in the latter case caused a permanent lengthening of the beam. The same strain was frequently applied afterwards, but I could not observe any increase of this effect. There was certainly a further apparent lengthening of both beams; but I ascertained that this arose from a slight wearing of the working parts of the measuring instrument, from the great number of measurements taken. In both experiments the beam was measured, first, in an erect position; and secondly, inverted; but in the tables, the measurements of the same parts of the beam are placed opposite each other, so that they may be compared throughout with greater facility.

Considering the very minute quantities which had to be measured, and the numerous causes of disturbance to which observations of so much delicacy were liable, such as changes of temperature or want of perfect uniformity in the dimensions or texture of the beams, the results, as shown by the column of differences, exhibit more regularity than could have been expected; and they point out the position of the neutral axis, as the centre of the beam, in a manner so decided, as to remove all further doubt upon this subject, not only in the smaller strains, but in the larger ones also; which, in the case of the second beam, were carried to about three-fourths of the breaking weight.

It will be observed also, that the extensions and compressions increase in an arithmetical ratio from the centre to the extreme upper and lower sides of the beam.

These experiments having established the fact that the neutral axis is in the centre of a rectangular beam, and that its position is not sensibly altered by variations in the amount of strain applied, it becomes evident that if there were no other elements of strength than the resistance to direct extension and compression, the well-known formula

$$w = \frac{2\,a\,d\,f}{3\,l}$$

should give the breaking weight when f is equal to the smaller of these two resistances, which in cast iron is the tensile resistance. But the weight so calculated is less than half the actual strength of the beam.

TABLE I.—*Measurements of the First Beam.*

Beam erect.					Beam inverted.								
No. 1.		No. 2		No. 3.	No. 4.		No. 5.		No. 6.		No. 7.		No 8.
At rest previous to being strained.	Difference.	Strained with 7373 lbs. on the end, equal to 14,746 lbs. on the centre.	Difference.	Weight taken off, condition the same as No. 1.	Beam reversed, bearing its own weight on the centre.	Difference.	Strain of 2893 lbs. on the end, equal to 5786 lbs. on the centre.	Difference.	Strain of 5133 lbs. on the end, equal to 10,266 lbs. on the centre.	Difference.	Strain of 7373 lbs. on the end, equal to 14,706 lbs. on the centre	Difference.	Weight taken off, condition the same as No. 4.
Micrometer readings.		Micrometer readings.		Micrometer readings	Micrometer readings.		Micrometer readings.		Micrometer readings.		Micrometer readings.		Micrometer readings.
2208	−70	2278	−67	2211	2210	−33	2177	−25	2152	−26	2126	+71	2197
2186	+55	2241	−53	2188	2187	−25	2162	−16	2146	−21	2125	+53	2178
2095	+36	2131	−33	2098	2103	−20	2083	−12	2071	−13	2058	+36	2094
2127	+14	2141	−13	2128	2129	−10	2119	− 8	2111	− 5	2106	+21	2127
2110	− 5	2105	5	2110	2117	− 2	2115	− 1	2114	+ 2	2116	——	2116
2052	−21	2031	+13	2044	2060	+ 5	2065	+ 6	2071	+12	2083	−20	2063
2095	−39	2056	+42	2098	2101	+15	2116	+14	2130	+19	2149	−37	2112
2052	−58	1994	+68	2052	2056	+21	2077	+21	2098	+29	2127	−60	2067
2101	−73	2028	+76	2101	2111	+28	2139	+26	2165	+34	2199	−73	2126

TABLE II.—*Measurements of the Second Beam.*

Beam erect.								Beam inverted.					
No. 1		No. 2.		No. 3.		No. 4.		No. 5.		No. 6.		No. 7.
At rest previous to being strained.	Difference.	Strain of 8000 lbs. on centre.	Difference.	Strain of 16,000 lbs. on centre.	Difference.	Weight removed.	Difference.	Strain of 8000 lbs. on centre.	Difference.	Strain of 16,000 lbs. on centre.	Difference.	Weight removed.
Micrometer readings.		Micrometer readings.		Micrometer readings.		Micrometer readings.		Micrometer readings.		Micrometer readings.		Micrometer readings.
1633	+37	1670	+65	1735	—89	1646	—44	1602	—56	1546	+97	1633
1525	+28	1553	+47	1600	—63	1537	—24	1513	—46	1467	+67	1534
1481	+21	1502	+34	1536	—44	1492	—19	1473	—28	1445	+42	1487
1442	+11	1453	+21	1474	—23	1451	—10	1441	—12	1429	+22	1451
1392	+ 2	1394	+ 7	1401	— 1	1400	+ 1	1401	——	1401	+ 4	1405
1375	—10	1365	— 9	1359	+18	1374	+17	1356	+11	1402	—17	1385
1338	—18	1320	—24	1296	+44	1340	+20	1360	+27	1387	—35	1352
1257	—27	1230	—37	1193	+64	1257	+31	1288	+43	1331	—57	1274
1248	—42	1206	—46	1160	+85	1245	+44	1289	+57	1346	—78	1268

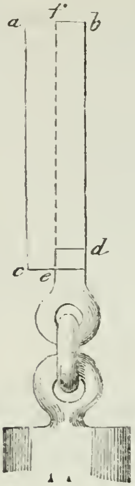
Note.—The extensions are marked +; the compressions are marked —.

In considering this question, I was forcibly struck by the circumstance, that, in applying the law of *ut tensio sic vis* to contiguous fibres, under different degrees of tension and compression, the effect of lateral adhesion is omitted, and each fibre is supposed to be capable of taking up the same degree of extension and compression from the same force as if it acted separately, and independently of the adjoining fibres. But it is well known as a practical fact, that there is a powerful lateral action which tends to modify the effect of unequal strains.

If, for example, a bar *a b c d*, have a strain applied at *e f d b*, the portion *d e f b*, will not be extended so much as it would be if separated from *a c e f*, unless an equal strain is applied to the portion *a c e f*. And if a portion of a bar cannot be extended in proportion to the force applied to it, unless the contiguous part is equally strained, it follows that the outer portions of a beam subjected to transverse strain will not be extended in proportion to the force applied, because the part nearer the neutral axis is not equally strained. The measurements made for obtaining the position of the neutral axis afford direct evidence on this point.

In the first beam, a strain of 5786 lbs. caused an extension of twenty-eight divisions of the micrometer; the points measured were $\frac{11}{12}$ths of the depth of beam. The extension of the outer fibres was therefore 28 × $\frac{12}{11}$ = 30 divisions. The micrometer reading before the strain was applied was 2111, and the total distance of the points measured, was

2111 + 51661 = 53772. The effect of the strain caused therefore an extension of $\frac{30}{53772} = \frac{1}{1792 \cdot 4}$ of the length. The beam was 7 ft. 4 in. long, 6 inches deep, and 2 inches thick ; and as



$$w = \frac{2\,a\,d\,f}{3\,l}$$

$$f = \frac{3\,l\,W}{2\,a\,d}$$

$$\text{or } f = \frac{3 \times 88 \times 5786}{2 \times 12 \times 6} = 10{,}608 \text{ lbs.}$$

so that, with a strain of 10,608 lbs. at the outer fibres, the extension produced was $\frac{1}{1792 \cdot 4}$ of the length.

But referring to the experiments made by Mr. Hodgkinson, it will be seen that a force of 10,538, applied by direct tensile strain, extends cast iron $\frac{1}{1056}$th of its length, being nearly double that exhibited by the beam. In the second beam, a weight of 8000 lbs. (from the mean of two results) produced an extension of forty divisions, which, at the extreme fibres, will be

$$40 \times \tfrac{12}{11}\text{ths} = 44 \text{ divisions.}$$

The mean reading of the micrometer, previous to the strain being applied, was 1439; therefore the extension was

$$\frac{44}{51661 + 1439} = \frac{1}{1207 \cdot}$$

The strain at the outer fibres produced by this weight was 14,666 lbs. so that 14,666 lbs. to the inch caused an extension of $\frac{1}{1207}$ th of the length.

But referring again to Hodgkinson's experiments on direct tensile strain, a weight of 14,793 lbs. produced an extension of $\frac{1}{645}$ths, of the length ; which is again nearly double that produced by the same strain when excited by a weight applied transversely.

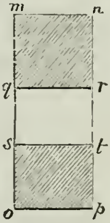
From these and other considerations I was led to think it probable that the effect of the lateral action of the fibres or particles of a beam, tending to modify the effect of the unequal strains and opposite forces, and thus diminishing the amount of extension and compression which would otherwise arise, constituted in effect a *resistance to flexure* ; and it will be found that the following experiments fully confirm the existence of this resistance, as an additional element of strength in beams ; and that it explains the apparent anomaly in the amount of tensile resistance when excited by direct, and by transverse strains.

Assuming the probability of a resistance acting independently of, or in addition to, the resistance of direct tension and compression, and varying with the flexure, it occurred to me that it might be exhibited experimentally by casting open girders, having the same sectional area in the upper and lower ribs; the same number of vertical ribs, but the distance between the horizontal ribs, and consequently the deflections of the girders different.

In these girders the neutral axis would necessarily be (like that of the solid beam) in the centre, and the sectional area of the ribs, subjected to tension and compression being the same in each, the circumstances under which rupture would ensue would be similar, except in the amount of flexure.

The formula for the strength of a girder of this form is as follows:—

Let a = the united area contained in the upper and lower ribs;
a' = the intervening space;
d = the total depth;
c = the distance between the upper and lower ribs;
l = the length of the bearing;
W = the breaking weight;
and F = the force required to produce rupture in the extreme fibres or particles.



Then $a + a'$ = the total area of the rectangle m, n, o, p,

$$\mathrm{W} = \frac{2d\mathrm{F}}{3l}(a' + a) - \frac{2od'}{3l} \times \frac{c\,\mathrm{F}}{d};$$

or

$$\mathrm{W} = \frac{2\mathrm{F}}{3l}\left\{(a'+a)\,d - \frac{a'\,c^2}{d}\right\},$$

$$\mathrm{W} = \frac{2\,\mathrm{F}a}{3l}\left(d + c + \frac{c^2}{d}\right).$$

The formula may also be obtained by calculating the moments in the usual way. Using the same letters as before, we have, for the distance of the centres of compression and extension,

$$\frac{2}{3}\left(d + \frac{c^2}{d + c}\right).$$

The force acting when F is the strain which breaks the outer fibre will be

$$\frac{\mathrm{F} + \frac{\mathrm{F}\,c}{d}}{2} = \mathrm{F}\frac{\left(1 + \frac{c}{d}\right)}{2}.$$

Hence

$$\frac{\mathrm{W}}{2} \times \frac{l}{2} = \frac{2}{3}\left(d + \frac{c^2}{d + c}\right)\left(\frac{1 + \frac{c}{d}}{2}\right)\frac{a\,\mathrm{F}}{2};$$

or

$$\mathrm{W} = \frac{2\,\mathrm{F}a}{3\,l}\left(d + c + \frac{c^2}{d}\right).$$

The value of W being obtained by experiment in each case, we have from the formula

$$\mathrm{F} = \frac{3l\mathrm{W}}{2\,a\left(d + c + \frac{c^2}{d}\right)}$$

and if the strength depended only on the direct tensile power of the material, F should in each case be constant, and equal to the direct tensile resistance; but if, in addition to this, there existed another element of strength in the resistance occasioned by the lateral adhesion and varying with the flexure, the value of F would be found, in every case, greater than the tensile resistance, and to increase when the flexure increased.

Four beams were cast of each form, of which the details, the exact dimensions, deflections, and breaking weights are given in the Appendix. The results were as follows, obtained from the mean of four experiments on each form of girder:—

Description of beam.	Total depth of beam.	Sectional area of the two ribs.	Distance between the ribs.	Deflection with nine-tenths of breaking weight.	Breaking weight.
	inches.	inches.	inches.	inches.	lbs.
Form No. 2	2·51	1·98	·54	·510	2468
" 3	3·00	2·20	1·00	·401	3119
" 4	4·00	1·98	2·03	·301	4339

The value of F being derived from each of these results by the formula

$$F = \frac{3lw}{2\,a\left(d + c + \frac{c^2}{d}\right)}$$

	Deflection.	Value of F.
Form No. 2	·510	35,386
Form No. 3	·401	31,977
Form No. 4	·301	28,032

The tensile strength of the metal obtained from the mean of eight experiments, given in the Appendix, was 18,750lbs; here, therefore, was decided evidence, first, that the value of F, exceeded the tensile strength in all three forms, and that it increased with the increase of flexure.

In connexion with the above described experiments, I made four others on solid beams having the same sectional area and length as the open girders; and the mean of the four gave a breaking weight of 1888 lbs. Obtaining the value of F, from these experiments, we have,—

Deflection with nine-tenths of breaking weight.	Value of F.
·670	41,709 lbs.

which again exhibits an increase in the value of F, with an increase in the deflection.

(To be Continued.)

On Steep Gradients of Railways, and the Locomotives employed.[*]

By Charles R. Drysdale, Assoc. Inst. C. E.

Read before the Institution of Civil Engineers, April 8th, 1856.

The object of the paper, was to compare the results of some of the performances of locomotives of various construction, and of stationary steam engines working ropes, and also the atmospheric system ; to examine these results, and from them to determine the most economical and best manner of effecting the passage of mountain chains by railway lines.

A history of the construction of the Semmering and Giovi passes was first given, with the nature of the curves, gradients, &c. The locomotives of the Semmering and Giovi were then described. Some English steep inclines were then referred to, and the duties of the Semmering and Giovi engines were compared with the English engines for evaporating power, for horse-power per cubic foot of water evaporated, and for weight drawn in proportion to the weight of locomotive.

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[*] From the Lond. Civ. Eng. and Arch. Journ., May, 1856.

After this the duty of the stationary engine on the Edinburgh and Glasgow line was analyzed, and the atmospheric incline on the St. Germain's railway.

The Semmering Railway.—A description was given of some of the most remarkable viaducts and tunnels of the line.

1. The viaduct of Kalte Rinne, which was composed of two stages, with a gradient of 1 in 80, and a radius 10 chains 600 feet long, with an extreme height of 150 feet.

2. The Wagner Graben viaduct had a gradient of 1 in 47; its length was 470 feet, and the greatest height was 127 feet.

3. The Semmering tunnel was 72 chains long; its greatest depth was 374 feet, lined with masonry. The length from Payerbach to Murzzuschleg was 21·52 miles, thus composed :—

	Miles.	Gradient.
Payerbach to Eichberg, .	3·84	of 1·46
Eichberg to Klamm, . .	2·53	" 1·40
Klamm to Breitenstein, .	3·26	" 1·47
Breitenstein to Semmering, .	3.58	" 1·54
Semmering to Spital, .	4·44	" 1·50
Spital to Murzzuschleg, .	3·84	" 1·50

The average gradient of Payerbach to the summit was 1·47 for 13·21 miles. The curvature was very great from Payerbach to Klamm; about 700 feet radius. The rails used weighed 88 lbs. to the yard. The engines employed had 75 square feet of fire-box surface; 189 tubes 2 inches diameter and 15 ft. 7 in. long = 1585 square feet heating surface, and 12·6 square feet of grate surface.

The weight of the engine filled and loaded, was $55\frac{1}{4}$ tons—$13\frac{1}{2}$ tons on the leading wheels, $12\frac{1}{4}$ tons on the middle, and 13 tons on the driving wheels. Toothed wheels were afterwards added, and thus all the weight was brought to bear for adhesion. The diameter of the cylinders was 18·7 inches, the stroke 25 inches, and the diameter of wheels 3 ft. $7\frac{3}{4}$ in. Before the toothed wheels were added to connect the tender to the locomotive, the duty of the engine required by government, was to draw 110 tons up 1 in 40, at ten miles an hour, consuming less than 144 cubic feet of dry wood per hour; to perform this, the load on the driving wheels must be at least eight times the tractive force available. Or $8 \times 11{,}040 = 88{,}320$ lbs., nearly 40 tons on the driving wheels was required. The resistance of 11,040 lbs. was calculated from the gradient 1 in 40, giving 56 lbs. per ton, due to the gravity, and the remaining 13 lbs. was due to speed and traction on the level.

The performance of the engine before adding the toothed wheels was, on a gradient 1 in 40, dead weight = 110 tons, engine and tender = $55\frac{1}{2}$ tons. The water evaporated per hour (stoppages not included)=255 cubic feet. The wood consumed to evaporate this = 3820 lbs. The speed = 11·4 miles per hour.

1°. This gave 4·15 lbs. of water evaporated per hour, by each pound of wood, or 9·6 lbs. water evaporated per square foot of heating surface.

2°. As to the horse power usually represented by the evaporation of

1 cubic foot of water per hour, 165 tons (engine and tender included) at 11·4 miles per hour, drawn up 1 in 40, gave 347 h. p., and 255 cubic feet of water evaporated ;—consequently ·73 cubic foot evaporated was equivalent to one horse-power.

The "Mammoth," Great Western Railway, = 0·76 cubic foot per h. p. per hour.

The Goods Engine, No. 227, North-Western Railway, = ·675 cubic foot per h. p. per hour.

3°. The proportion that the dead weight bore to the weight of the engine and tender, gave the following results :—

The Semmering engine, = 4·2 h. p. per ton of engine and tender.

The "Mammoth" = 3.2 h. p. per ton of engine and tender.

The North-Western No. 227, = 3·55 h. p. per ton of engine and tender.

These experiments were brought forward to show, that no engine in England would alone work the Semmering traffic. When the hinder wheels were connected with the others in the Semmering locomotive, the performance rose to 220 tons up 1 in 40, at 9½ miles per hour, giving with the engine and tender included a duty of 380 horse-power ; and 165 tons dead weight carried up by 55¼ tons of engine gave $\frac{285}{55 \cdot 25} = 5 \cdot 2$ h. p. exerted per ton of engine and tender.

The mean pressure of steam was 80 lbs.

Lastly the economical effect stood thus:—44 lbs. of water were evaporated, and 11 lbs. wood were consumed per h. p. per hour including the engine and tender. Without these:—14·6 lbs. of wood were consumed per horse-power per hour, giving 14·6 lbs. to raise 33,000 × 60 lbs., or 1 lb. of wood to raise 13,600 lbs. a foot high; or again, 82,208 lbs. irrespective of speed.

The Giovi Incline.—On the Giovi incline passing the Appenines, near Genoa, on the Turin and Genoa Railway, the engineer who introduced the working of this line by locomotives, had to contend against a strong party who were in favor of stationary engines.

The Giovi incline commenced at 7¾ miles from Genoa, 295 feet over the sea, and ascended for 6 miles to an elevation of 1184 feet. Average gradient 1 in 36 ; the length of tunnel = 2·55 miles ; the depth of shaft = 600 feet ; the cost per yard = £118.

Two engines of the same size (built by Messrs. R. Stephenson & Co.) coupled together and managed by one driver, were used to work the incline. Each carried its own coke and water. The diameter of wheels = 3 feet 6 inches. The cylinders = 14 inches, with a stroke = 22 inches. The locomotives were bolted together with the fire-boxes facing each other, and the driver stood on a common platform. Filled and loaded the two engines weighed 50 tons.

In fine weather the locomotives took up about 100 tons of load, and in the worst weather never less than 70 tons, at a speed of 15 miles per hour. The consumption of coke per ton per mile, amounted to, not including engine, 1·94 lbs.; including engine 1·16 lbs. The consumption of coke to draw the engine from the bottom to the top, 6 miles, of 1 in 36, was 8·27 cwt.

1°. The water evaporated per pound of coke, was 8·5 lbs.
2°. 150 tons drawn up 1 in 36, at 15 miles per hour, gave a result, with the engine of 444 horse-power; and without the engine 295 horse-power.
3°. This gave 5·9 tons raised per ton of engine.
4°. 9·7 lbs. coke raised 1,980,000 lbs.
Or 1 lb. coke, 204,000 lbs. 1 foot high.
Or, irrespective of speed, 169,600 lbs.

The *Accrington Incline* was 1 in 41·6 for two miles. 71·6 tons were raised at 6·31 miles per hour up the incline. The engine had cylinders 18 inches diameter, 24 inches stroke, 6 coupled wheels of 5 feet diameter.

The weight of the engine = 26·25 tons; tender = 16·75 tons;—total = 43·00 tons. The work done = 74 horse power, which gave 1·7 horse power raised per ton of the engine and tender.

The *Lickey Incline* had a gradient of 1 in 37, worked by goods engines with cylinders 16 inches diameter, and 24 inches stroke, and driving-wheels 5 feet diameter, and weighed 32 tons, with an assisting engine whose cylinders = 16 inches, and stroke of 24 inches, and driving-wheels of 4 feet diameter, weighing 35 tons; together = 67 tons. The results were that 240 tons were drawn up 1 in 37, at a speed of 6½ miles per hour, giving 293 horse power, or 4·4 horse power exerted per ton of motor.

The *Edinburgh and Glasgow Incline.*—This incline was stated to be 1¼ mile long, with a gradient of 1 in 42. During a trial of twenty-three months, the miles run lifting trains were 21,250½, and the number of ascents = 14,167.

The number of carriages drawn up = 205,181.

The average gross weight per train = 86 tons.

The prime cost of the rope = £1094.

The coal consumed per mile to lift this weight of 86 tons = 527 lbs.

Cost of coal per mile = 11·195*d*.

The friction of the rope = $\frac{1}{20}$ of its weight.

The cost of working the line, including the rope, = 50·299*d*.

The performance was 86 tons drawn up 1 in 42, at 30 miles per hour, giving 452 h. p. To this was to be added 211 h. p. to move the rope; and 35 lbs. of coal were expended per horse power.

Secondly, without consideration of speed, 1 lb. of coal raised 45,700 lbs. 1 foot high.

The incline was worked by a wire rope of 4⅝ inches, and on several occasions there had been 30 loaded carriages on each train, and goods trains of 120 tons, carried up without detention.

The total cost of working the incline for one year was £734 18*s*. against £3204 16*s*. for locomotives, giving a difference in favor of the stationary engine of £2460 18*s*. 9*d*.

The engines used on the line were probably not well adapted for the traffic, and indeed, for such short inclines, the benefit of the stationary engines was very doubtful; there seemed, however, to be some propriety in using them for the passage of long Alpine gradients, as a rope could be made to work a length of 6 miles, and thus steeper gradients might be adopted—even 1 in 25, avoiding thereby great expense in constructing viaducts, &c.

St. Germain's Atmospheric Railway.—The gradient at the St. Germain's incline was 1 in 33 for the distance of fifty chains, and the total length of the inclination was 1·46 miles with an average gradient of 1 in 43.

From June 2d, to August 18th, 1855, the number of ascents = 1413; the weight of carriages lifted = 73,241 tons. The total cost of working, including tallow, engine-men, coal, water, &c., = £612 10*s*. The cost per mile of ascent, = 5*s*. 9½*d*. The average weight raised per train = 51·8 tons. The cost of coal = 20*s*. per ton. Economically, leaving speed out of consideration, 1 lb. of coal raised 31,136 lbs. 1 foot high.

The following summary of results was given:—

Semmering Locomotives.—Total h. p. exerted = 380 h. p.; to lift the train = 285 tons; h. p. per ton of motor = 5·2 tons. Economically (irrespective of speed), one lb. of wood raised 82,208 lbs. 1 foot high.

Giovi Locomotives.—Total h. p. exerted = 444 h. p. per ton of motor = 5·9 h. p. economically (irrespective of speed), 1 lb. of coke raised 169,600 lbs. 1 foot high.

Glasgow Stationary Engine.—Total h. p. to raise the train = 452 h. p. without the h. p. to lift the rope, economically, one lb. of slack raised 45,700 lbs. one feet high, irrespective of speed.

St. Germain's Atmospheric System.—One lb. of coal raised 22,063 lbs. one foot high, irrespective of speed.

These results, as compared with the alleged duty of the Cornish boiler, one million pounds, one foot high, were still far below laboratory duties.

April 15.—The discussion being renewed on Mr. Drysdale's Paper, was continued throughout the evening. It was stated that on the Oldham incline, 1½ mile in length, with a gradient of 1 in 27, a tank engine weighing about 27 tons, drew at the rate of 15 miles per hour, a train of nine loaded carriages weighing 50 tons. The dimensions of the engine were—leading wheels, 3 ft. 6 in. diameter; driving wheel (four coupled), 5 feet diameter; cylinders, 1 ft. 3 in. diameter; length of stroke, 2 feet.

It was argued that it was extremely difficult, to establish any useful comparison between the working of various inclines, in consequence of the dissimilarity of conditions, of local circumstances, and of the different modes of keeping account of the expenses. That instead of affixing the limit of adhesion, as on the Semmering, at eight times the weight on the wheels, as compared with the force of the pull of the engine, it would be practicable to ascend much greater inclines with only five times the weight to the drag of the engine. That the Semmering engines could not be received as any improvement upon the construction of the engines employed ten years ago at the Lickey incline, where two small engines had been in the habit of drawing, up a gradient of 1 in 37, trains of 50 loaded wagons, weighing at least 250 tons, at a speed of 6½ miles per hour; therefore that one of these comparatively small light engines, would be quite able to haul 165 tons over the Semmering incline, at a speed of 11 miles per hour.

Though it could not be denied that English railway engineers were formerly prejudiced against any steeper incline than 1 in 100, and had believed that gradients of 1 in 50 could only be worked by means of ropes, yet it must be remembered that fifteen years ago, Halifax was approached by a gradient of 1 in 44, and that twenty-two passenger trains per day, besides goods trains, were, without difficulty, conveyed over that incline by locomotives. There was, therefore, nothing new in these steep inclines, nor in the manner of working them. It should also be mentioned, that the result of the later experience went to prove, that it was more advantageous to rely on the locomotive than on any system of ropes. Not only had the latter system been abandoned on the Euston incline (London), and at Miles Platting incline (Manchester), but even at Oldham, where there was a gradient of 1 in 27 for 1¾ miles, the rope was taken away two years ago, and the traffic was now entirely dependent on locomotives.

It was urged, that as early as 1839-40 the Lickey incline had been freely ascended by locomotives conveying trains, without any brake in the course; the conditions of the Lickey and of the Dainton inclines, situated on the course of the lines, were very different from those of terminal inclines, such as the Oldham, Halifax, Manchester, &c.

The sharp curves, of not more than 10 chains radius, on the Semmering, must be taken into consideration, as on a gradient of 1 in 42, they would materially influence the working of the engines, at even a moderate speed. The question was, whether it was necessary to have such heavy engines as those of the Engerth construction, or whether it was not more convenient and economical to work inclines by means of two coupled engines, as at the Giovi incline. The latter opinion was strongly contended for, as also that generally the inclines in England were worked better, cheaper, and more regularly than that of the Semmering. In the year 1833, locomotive engines frequently ascended the St. Helen's incline of 1 in 30, although the traffic was worked by means of ropes.

Particulars were given of some experiments made with an engine intended for the Santander and Alar railway, in Spain; from which it appeared that upon an inclined plane, at Sheffield, about 300 yards in length, and rising 1 in 27, the engine drew up 23½ tons, (exclusive of the tender,) at a velocity of about 2½ miles per hour. The same engine, when tried on the Lickey incline, on a foggy day, with drizzling rain falling, took up in the first experiment a load of nearly 46 tons in six wagons at an average rate of about 10 miles per hour, and in the second experiment 29¼ tons, in four wagons, at a mean velocity of 18½ miles per hour.

It was again insisted, that circumstances varied so much as to render comparison of working the inclines almost impossible. It was necessary either to have special experiments under special circumstances, or to have such a large number of experiments as to arrive at the truth, by taking the average of the results. It was evident that the load that could be hauled by an engine, was in proportion to the weight that could be put upon the driving-wheels; but that was limited by circumstances.

In order to arrive at some idea of the relative advantage of employing one very powerful, or two less powerful engines, two engines of equal power were taken, their speed and pressure compared, and a similar load of 280 tons, was placed behind each. It was thus found that the two engines, when coupled together, took both loads up the same incline in the same time that each had taken up the half load separately.

At Edge-Hill, Liverpool, there were three inclines, of 1 in 48, 1 in 90, and 1 in 56, respectively. These were still worked by ropes, and stationary engines, because, being situated in tunnels, it was found that the condensation of the steam on the rails when locomotives were tried, so lessened the adhesion, that in these particular cases it almost amounted to an impossibility of carrying out that system.

The important point to consider was the amount of adhesion to be obtained: one-eighth the weight was contended to be a fair average, as under certain circumstances of weather, &c., it fell to one-tenth, or one-fifteenth. That point being determined, the rest was a question of the advantageous employment of steam and the construction of the engines themselves.

It was stated that the Paper should be received as a record of facts, brought by the author under the notice of the Institution, rather than with a view to establishing any particular ideas as to modes of working inclines.

It must be evident that the system of working the Giovi incline by two of Messrs. R. Stephenson & Co's. coupled engines was decidely better and more economical, than the system of using such enormously heavy engines, as those constructed from the Engerth design for working the Semmering incline. It was decidedly more economical, as well as more convenient, to be able to work an incline by merely coupling together the ordinary engines of the line, than to have engines constructed expressly for the duty of ascending steep gradients, and unfit for the other portions of the line. Besides, the injury to the permanent way by such enormously heavy engines must be considered, when comparing their duty with that of two engines, whose weight was so much better distributed.

Circumstances of climate would always affect adhesion;—in the fine dry cold climate of Norway, inclines could be advantageously worked; whereas in London fog, or even with the ordinary moisture of a dewey night, the adhesion would be materially impaired.

Ropes had been generally superseded by locomotives, but it should not be rashly decided to abandon them entirely, as there were situations were steep terminal gradients might still be advantageously worked by them; whereas it would be preferable, or even almost indispensable, to work the inclines in the course of a line by locomotive power. The difference between current and terminal inclines must always be considered. The facts observed and collected by the author would be found valuable as data, from whence every engineer would draw his own conclusions, and apply them so as to meet the peculiarity of his own case.

In conclusion it was urged that, with regard to adhesion, no *a priori* arguments should be relied on, but facts alone should be had recourse to, and these, it was asserted, would be found to give the power of adhesion as being from one-eighth to one-tenth of the weight on the wheels. It was thought to be of great importance that the question of the comparative economy of working inclines by locomotives or by ropes, should be clearly investigated. In hilly districts, if gradients of 1 in 20 could be worked with facility, the construction of many costly viaducts and other structures might be avoided; and, of course, the less the expense necessary to be incurred in the formation of any railway the greater chance was there of its being satisfactorily executed.

AMERICAN PATENTS.

List of American Patents which issued from April 29th, to May 27th, 1856, (*inclusive,*) *with Exemplifications.*

APRIL 29.

202. For an *Improved Sawing Machine;* Thomas J. Alexander, Westerville, Ohio.

Claim.—"1st, Giving to the revolving saw a reciprocating action across or along the bed, in combination with the reciprocating movement of the bed or table, simultaneously in opposite directions. 2d. Hanging or supporting the revolving saw and bed or table, to give them their specified compound parallel, or otherwise equivalent reciprocating movement, simultaneously in opposite directions, or to radial arms geared together by toothed segments, or otherwise equivalently connected or driven, to produce the necessary contra joint action of said radial arms, whereby the proper reciprocating actions of the saw and bed relatively to each other, are ensured, and the movement of the one may be made to actuate the other."

203. For an *Improvement in Chain Cable Hooks;* Enoch Applegate, Wilmington, Delaware.

Claim.—"The hinged arms, and projections for supporting the anchor, in combination with the lock lever and projections."

204. For an *Improvement in Electro-Magnetic Telegraphs;* Henry N. Baker, Union, New York.

Claim.—"The arrangement of the type wheel, the escapement wheel attached thereto, the arrangement of the clutch or detent acting upon the said escapement wheel, relatively to the armature of the type wheel magnet, and the arrangement of the whole relatively to the tongue, by which the types are lifted up into contact with the paper, in such a manner, that when the circuit is closed through the type wheel magnet, the tongue will be opposite a space between two letters, and when during the closing of said circuit—the circuit by which the said tongue and the feed rollers are acted upon is closed, the tongue will be inoperative and the feed rollers allowed to act, without any impression being given, thereby producing a space between the printed letters or words."

205. For an *Improved Pen and Pencil Case;* Edward Baptis, Hoboken, New Jersey.

Claim.—"The two spiral grooved tubes. when arranged so that the pen holder and pencil slide will be shoved alternately in and out by the case, and moved simultaneously in opposite directions."

206. For an *Improvement in Cradling Harvesters;* Milton Barlow, Lexington, Kentucky.

Claim.—"Constructing and operating the cutting portion of the machine, so that by the use of the eccentric, or a cam or crank as substitute therefor, operating on the cradle, when in combination with means of delivering the cut grain by the use of a rake."

207. For an *Improved Machine for Excavating and Moving Earth;* Asa W. Cady, Sullivan. New York.

Claim.—"The plan embodied in the structure of the bridge and scraper contained in their form, and method of use in the machine, and in the arrangement made for operating and controlling these with the gearing and fixtures, as actuated by hand or horse-power, and in adapting them to and combining them with a wheeled vehicle or wagon, so the operation of excavating earth may be performed."

208. For an *Improvement in Cigar Machines;* William Dorson, Huntington, Conn.

Claim.—"The combination of the forming rollers, the flexible apron and the spring dies."

209. For an *Improvement in Scaffolding;* John M. Dearborn, Boston, Mass.

Claim.—"This improvement in the construction of movable scaffolds, which consists, first, in constructing the upright standards of two planks or boards, leaving a space between them, in which spaces the ledgers can be moved up or down, and secured in any desired positions. Also, constructing the upright standards with tenons on the top, which fit into the bottom space, strengthened by an iron sleeve between the planks of the upright standards of the next upper section, whereby I am enabled to extend the staging vertically."

210. For an *Improvement in Joint Bodied Buggies;* Edwin J. Green and Moses H. Wheeler, Cedarville, New York.

Claim.—"Supporting the front or seat section of a joint body carriage on a spring reach, by means of a bolt or equivalent support, whereby we avoid the use of a spring, as heretofore used under the seat, but still have the advantages of said spring, by using the spring reach as such."

211. For an *Improvd Shingle Machine;* John B. Evins, Greencastle, Indiana.

Claim.—"1st, The combination of the knife frame and panel frame, when constructed, arranged, and operating conjointly. 2d, Operating the knife and panel frames, by means of the lever, when connected to the two levers, so that two movable fulcrums are obtained, the pitman being attached to the lever between the fulcrums."

212. For an *Improvement in Hand Seed Planters;* Edward Hopkins, Cincinnati, O.

Claim.—"The arrangement of the rod and spring, combined with the catch block and sliding plate, for operating the semi-circular cylinder and lid."

213. For an *Improvement in Attaching Harvester Cutter Blades to the Sickle Bar;* W. H. Hovey, Springfield, Mass.

Claim.—"Attaching the teeth to the sickle bar, by means of the grooved pins and bar, attached to the bar, and the plate having holes and slots made through it."

214. For an *Improvement in Automatic Rake for Harvesters;* Salem T. Lamb, New Washington, Indiana.

Claim.—"Giving the rake its circular motions, by means of the traversing and rocking cam, in combination with the revolving cam, which gives the longitudinal motion, through the intervention of the devices."

215. For an *Improvement in the Construction of Dry Gas Metres;* William Lyon and Charles W. Dickinson, Newark, New Jersey.

Claim.—"1st, So constructing the metallic bellows for the measurement of gas, that the spring or bend of the metal may form chambers of varying dimensions and of definite capacities for receiving and measuring the gas. 2d, Giving motion to the registering wheel by the impinging lever operated by the wheel, and the levers and connexions communicating with the bellows."

216. For an *Improvement in Corn Shellers;* Ebenezer Mathers, Morgantown, Va.

Claim.—"The construction of the shaft with channels—said channels being furnished with elastic tongues."

217. For an *Improved Machine for Printing Woolen and other Fabrics;* John M'Innes, Braintree, Mass.

Claim.—"The general construction and arrangement of the machine: that is to say, the vertical cylinder with its series of blocks, in combination with a corresponding series of sieves."

218. For an *Improvement in Door Fasteners;* Elisha P. Moulton, Baltimore, Md.

Claim.—"Constructing turn buttons, or fasteners, the stem and head of the button being in one piece, and having a collar at its end that prevents the button from being withdrawn from its frame, by the strain brought on the head of the button by the door which it secures—the stem of the button having a square part that is pressed against by a spring."

219. For an *Improvement in Corn Planters;* Silas G. Randall, Rockford, Illinois.

Claim.—"The combining with the seed tube, a cut-off valve, for closing or opening said tube, as the case may be; said valve moving edgewise against the soil when the passage is opened to allow the grains to pass into the ground, and operated from a lever."

220. For an *Improvement in Harvester Cutters;* Benjamin T. Roney, Philadelphia, Pennsylvania.

Claim.—"Slotted bar and cutter bar, as connected together by the cross pieces, in combination with the cutter levers—their knives, projecting pins—the whole being arranged in conjunction with the fulcrum."

221. For *Improvements in Rotary Steam Engines;* John B. Root, Brooklyn, N. Y.

Claim.—"The contrivance of the steam ports, passages and stop bars, arranged in connexion with the piston rollers so as to let the steam in upon the rubber, at different and opposite sides of the cylinder, at as many places as the number of rollers used shall require—thus acting upon the rollers at different and opposite points—thereby relieving the centre shaft from side pressure and friction, and also, increasing the power of the engine with the increase of the number of steam ports and piston rollers. Also, the arrangement and device of the movable plates and the stationary plates and collar, with the friction rollers and metallic bars or arms, for the purpose of adjusting the piston rollers."

222. For an *Improved Wrench;* Bradford Rowe, Albany, New York.

Claim.—"The solid movable jaw, sliding between the parallel side pieces, to which the fixed end jaw is attached. Also, the bevel wheel and screw-gearing to move the jaw, in combination with the solid movable jaw."

223. For an *Improvement in Breech Loading Fire Arms;* Simon F. Stanton, Manchester, New Hampshire.

Claim.—"1st, Raising the chambers into line with the barrel, by the action of revolving them. 2d, The peculiar form of the breech piece, with its elevated and depressed portions and inclined planes—whereby, as one charge chamber is raised into line with the barrel, the one last discharged is forced down by the inclined plane into its vertical position. 3d, The method of securing the chambers in position, without interrupting their motions, by means of the lever. 4th. The ring, constructed and operating for the purpose of arresting the motion of the revolving chambers, and closing the joint between the barrel and the chamber. 5th, The combination of the devices, whereby the ring is driven forward to release the charge chambers before they are revolved. 6th, The safety stop, for the purpose of preventing the fall of the hammer, whenever the ring is not drawn over the joint between the barrel and the charge chamber."

224. For an *Improvement in Reaping Machines;* Pliny Thayer, Lansingburg, N. Y.

Claim.—"In combination with the raker's stand and the usual platform for receiving the cut grain, the rearward inclination and extension of said platform from the line, so that the raker may move his rake with the natural sweep of his arms or body in raking the gravel from the platform."

225. For an *Improved Machine for Manufacturing Friction Matches;* Alexander Underwood, German Flats, New York.

Claim.—"1st, The cutting and rocking device formed of the several parts or elements. 2d, The manner or mode of feeding the blocks or billets of wood to the cutters by the alternate lateral shifting motion, the box caused through the intervention of the devices, combined with the fluted rollers, &c. 3d, The toothed or geared reciprocating crank device, with the combination parts and the dipping pan. 4th, The construction of the endless chain rack devices, formed with series of pins or teeth together, in combination with the intermittent rotary rack carrier and crank ratchet device. 5th, The boxing and capping device."

226. For an *Improvement in Box Openers;* Charles P. S. Wardwell, Lake Village, New Hampshire.

Claim.—"The employment of rotary dogs, or their equivalents. Also, the combined arrangement of the spring and flattened shanks of the dogs, whereby the wedge lips of the dogs are kept in the same line or parallel with each other for convenience of insertion, without hindering the desired rotary motion of the dogs."

227. For an *Improvement in Fire Arms;* Frederick Newbury, Albany, New York.

Claim.—"1st, The method of operating the block by the hammer, in combination with the forked lever, the spring, and recoil stop pin, reference being had to the peculiar form of the lever. 2d, The formation of the front trigger guard into a sear spring, and its attachment to the lower end of the trigger."

228. For an *Improvement in Machines for Paring Apples;* Ephraim L. Pratt, Philadelphia, Pennsylvania.

Claim.—"Attaching the lower end of the knife shaft to the stud projecting from the larger segment, by a flat steel or other spring, for enabling the said knife shaft to have a slight vibration through the twisting or torsion of said spring, for the purpose of adapting the edge of the knife to the inequalities of the surface of the apple during the process of paring, and enabling the elasticity of the spring produced by the twisting or torsion of the same, to be exerted toward bringing the edge of the knife, when thus moved, back to its proper relation to the surface of the apples."

229. For an *Improvement in Self-Rakers for Harvesters;* Thomas T. Whitaker, St. Charles, Illinois.

Claim.—" 1st, The rock-shaft, in combination with the rack and connecting shaft. 2d, In combination with the rake, the cradle. 3d, The method of adjusting the rake, so as to enable it to rake from platforms of different widths of cut."

230. For an *Improvement in Corn Planters;* Samuel Wilt and George W. Albaugh, Green Castle, Pennsylvania.

Claim.—" The use of the slide in corn planters, when provided with expanding grain receptacles."

231. For an *Improvement in Propelling Boats;* S. W. Wood, Washington, D. C.

Claim.—"The arrangement and combination of the horse power and paddle wheels, whereby the raising and lowering of the paddle wheels to suit the various depths at which the boat sinks, and produces variable inclination of the horse power, so as to enable the horse to exert a power proportioned to the weight of the load."

232. For an *Improved Lathe;* Albert H. Brown, Assignor to Tingley & Viele, Albany, New York.

Claim.—" The form and arrangement of the cutter stocks with the cutting tools attached, so as to partake of the curvilinear motion of the stock, and pivoting them upon the slide rest, in combination with the apparatus for transferring the lines of the pattern by the motion of the stocks to the cutters, so as to produce a turned surface of which the edge of the pattern is a sectional representation."

233. For an *Improvement in Machines for Cleaning Knives;* A. C. Ketchum, Assignor to Edward B. Olcott, City of New York.

Claim.—" Subjecting the knife blade while secured upon the bed piece to the requisite friction or rubbing, by means of the strips attached to the underside of the board."

234. For an *Improved Machine for Embossing and Printing;* Samuel W. Lowe, Philadelphia, Assignor to Jacob M. Beck, Harrisburg, Penna.

Claim.—" 1st, The employment of two segmental rollers, in combination with a traversing frame or table—said table having a loose plate, by removing and replacing which, the said segmental rollers may be used for embossing for printing from engraved plates, for which a patent was granted to me, on the 18th of September, 1855, or for printing from common type. 2d, The radial adjustable arm, in combination with the lower segmental roller, for the purpose of limiting the distribution of the ink to the engraved plates attached to said rollers."

235. For an *Improvement in Harvester Fingers;* John Reily, Heart Prairie, Wis.

Claim.—" Hardening that part of the tooth on which the knife works."

ADDITIONAL IMPROVEMENTS.

1. For an *Improvement in Ventilating Railroad Cars;* George F. Foote, Buffalo, New York; patent dated July 11, 1854; additional April 8.

Claim.— "A small door that may be opened or shut, in connexion with, and as a part of a car window, that may be raised or opened in the usual way."

2. For an *Improvement in Grain Binders for Harvesters;* George W. N. Yost, Pittsburgh, Penna.; patent dated Jan. 1, 1856; additional April 8.

Claim.—" 1st, The long lever, operated by projections and spring. 2d, The arrangement and combination with the cams for operating the compresser, the lever, bevel gearing, and pulley wheel on the pinion shaft. 3d, The guards."

3. For an *Improvement in Grass Harvesters;* George Esterly, Heart Prairie, Wisconsin; patent dated June 27, 1854; additional April 22.

Claim.—" Connecting the projections which are on alternate sections of the sickle to the bar, so that the said bar may be on top of said sections."

RE-ISSUES FOR APRIL, 1856.

1. For an *Improvement in Printing Presses;* George P. Gordon, City of New York; patent dated August 5, 1851; re-issued April 8, 1856.

Claim—" 1st, A rotating reciprocating platen, operating as described. 2d, The arrangement of two side arms, so combined as to form a frame to carry the inking rollers both forward and backward over the form for each impression. 3d, Throwing a vibrating bed from the point of its receiving the inking rollers directly to the impression by means of toggles arranged as shown, so that said bed after receiving the impression will be allowed to recede or fall back to its original position by its own gravity. 4th, The combination of the vibrating bed with the roller frame. 5th, The grooved cam-shaped guides, for throwing the frisket in the proper direction, and holding it in the desired positions during the intervals of rest given to the platen."

2. For an *Improved Mode of Constructing Walls and Floors of Cellars;* Augustus R. Moen, City of New York, patent dated Feb. 26, 1856; re-issued April 8.

Claim.—"The mode of forming walls and floors by combining into one mass the water cement and asphaltum, by means of the solid building materials, by which the asphaltum is caused perfectly to adhere to the bricks or stone of the wall built with a water cement which also adheres to the same stone or brick."

DESIGNS FOR APRIL, 1856.

1. For *Clock Case Fronts;* Nicholas Muller, City of New York.

Claim.—"The female figure, peacock, and foliage, when arranged and combined as shown."

2. For *Parlor Stoves;* Samuel H. Ransom, Albany, New York.

3. For *Six Plate Stoves;* Samuel H. Ransom, Albany, New York.

4. For *Stove Plates;* Samuel H. Ransom, Albany, New York.

5. For *Cooking Stoves;* Samuel H. Ransom, Albany, New York.

6. For an *Elevated Oven Cooking Stove;* Samuel H. Ransom, Albany, New York.

Claims to Nos. 2, 3, 4, 5, and 6, the combination and arrangement of ornamental figures and forms, each forming an ornamental design.

7. For *Chandeliers;* Samuel B. H. Vance, City of New York, Assignor to Mitchell Bailey & Co., Connecticut.

Claim.—"The design, configuration, and arrangement of the several parts and ornaments."

8. For *Parlor Stoves;* N. S. Vedder and Wm. L. S. Sanderson, Assignor to Sanders, Wolfe and Warren, Troy, New York.

Claim.—"The ornamental design and configuration."

9. For *Metallic Pens;* Albert Granger, City of New York.

Claim.—"The device impressed on the pen, to wit: a medallion bearing a likeness of Washington."

10. For *Cooking Stoves;* Samuel H. Ransom, Albany, New York.

Claim.—"The combination and arrangement of ornamental figures and forms represented, forming together an ornamental design."

11. For *Gas Ovens;* Edward J. Delany, Assignor to Cresson, Stuart & Peterson, Philadelphia, Pennsylvania.

Claim.—"The design for gas ovens."

12. For *Summer Furnaces;* Jacob Beesley, Assignor to Cresson, Stuard & Peterson, Philadelphia, Penna.

Claim.—"The design for summer furnace."

13. For *Castors;* Wm. H. Green, Meriden, Connecticut.

Claim.—"The general design and configuration of the castor."

14. For *Stove Plates;* Harvey Smith and Frederick A. Sheldon, Troy, New York.

Claim.—"The design and configuration forming an ornamental design for stove plates."

15. For *Clock Case Fronts;* Nicholas Muller, City of New York.

Claim.—"The wreath and figures, arranged and forming a new and ornamental design."

16. For *Clock Case Fronts;* Nicholas Muller, City of New York.

Claim.—"The female figure, reclining or sitting upon the sheaves."

MAY 6.

1. For an *Improvement in Breech Loading Guns;* Edward Lindner, City of N. York.

Claim.—"1st, The application of a lever, projecting partly into the gun barrel, or of a piston forming part of the barrel, in such a manner, that the passage of the ball through the gun barrel, or the explosive power of the powder, shall act upon the same, pressing the same outwards, for the purpose of communicating motion to a rod, situated below the gun barrel. 2d, The manner of disengaging and opening the breech, by a motion obtained either by the passage of the cartridge through the gun barrel, or by the action of the expansive power of the powder when the gun is fired off. 3d, The box containing asbestos, or its equivalent, for the purpose of cleaning the rubbing surface of the breech in its motion upwards. 4th, The arrangement of packing the axis of the breech against the face of the gun nipple frame. 5th, The arrangement of the vent or priming hole, from the gun nipple to the cartridge chamber in the breech. 6th, Filling the space in the recess with asbestos, or its equivalent."

2. For an *Improvement in Repeating Fire Arms;* George Leonard, Shrewsbury, Mass.

Claim.—"The invention in fire arms of an expedient for connecting several eccentric barrels to a chamber having an equal number of bores, and for partially, but not wholly disconnecting the same, for the purpose of loading, cleaning, &c., consisting of a combination of a central screw, with a spindle, having a projecting head and a bore of two different diameters in the centre of the concentric barrels, the front part of the bore being larger than the back part, and of the diameter of the projecting head and the back part of the bore being smaller than the front part, and of the diameter of the spindle. I claim the invention in fire arms of a combination of a cocking lever, trigger, and sear, with a thumb piece; the combination to have such characteristics, that the fire arm can be uncocked without discharge, only by pressing said thumb piece, and easing down said cocking lever."

3. For an *Improvement in Machines for Figuring and Polishing Morocco;* Eugene L. Norton, Charlestown, Massachusetts.

Claim.—"The rotating tool for polishing or figuring leather, when such tool has imparted to it a greater velocity than that due to rolling simply."

4. For an *Improvement in Gas Burners;* James Neal, Boston, Mass.

Claim.—"Constructing the burner not only with a covered cup or stand reservoir, and a discharging pipe extending into said reservoir, but with one or more passages for the gas to flow around and into the cup, and through its loose sand or straining contents; my improvement enabling me to employ powdered quartz, or a loose mineral matter or substance, as a filter or strainer, and thereby attain advantages."

5. For an *Improvement in Machines for Sawing Marble Kerfs of Varying Angles;* Samuel Nickelson, Pulaski, Tennessee.

Claim.—"The adjustable or sliding bars, when said bars are curved or bent, so as to form saw frame guides, in combination with the pivoted pitmans and eccentrics on the shafts, whereby the saw frames and the devices for drawing them are all attached to and move with the bars; thereby allowing the saws to be adjusted more or less angularly with each, and at required distances apart, with the greatest facility."

6. For an *Improvement in Preparing Artificial Stone;* Robert Neisch, City of N. York.

Claim.—"The preparation of artificial stone, by treating plaster of Paris, previously calcined, together with sulphuric acid, with solutions of alum and carbonate of ammonia."

7. For an *Improvement in Ovens;* Jesse Ohmert, Mt. Morris, Illinois.

Claim.—"The arrangement of the flues and spaces relatively with the fire chamber and oven."

8. For an *Improved Apparatus for Lubricating Grist Mill Spindles;* Clayton Brown, Sen., Richmond, Indiana.

Claim.—"The oil chamber, with tube attached; the tube being provided with a stop-cock, and the chamber with a piston or follower, the inner end of the tube passing through the bush."

9. For an *Improved Rotary Shingle Machine;* C. F. Beverly, Lancaster, Ohio.

Claim.—"Securing the knives or cutters to the wheel or disk, by means of the bolts which pass through the knives or cutters near their cutting edges, and through the ears at the ends of the plates, the heads of said bolts being beveled and employing the screws for securing the ears to the bars attached to the wheel or disk, and adjusting the knives or cutters by means of the screws which pass through the bars. I further claim the bar, attached to the elastic bars, by rods which work in slotted rails at the ends of the platform or bed; the lower ends of the bars being connected to the rock shaft, having a treadle attached to it, and against which treadle a spring acts, for the purpose of feeding and properly presenting the block to the knives or cutters."

10. For an *Improved Construction of Guides or Chutes for Turbine Wheels;* Joseph Bastion, Theresa, New York.

Claim.—"The stationary conical centre, in combination with the adjustable parts and supporters, for the purpose of graduating the quantity of water discharged, and giving the desired direction to the same."

11. For an *Improved Wagon Tongue;* J. T. Baughman, Frazeysburgh, Ohio.

Claim.—"1st, Constructing the tongue in two separate parts. 2d, The arrangement and combination of the hounds for the purpose of connecting the tongues together."

12. For an *Improved Vise;* Charles Buss, Marlboro', New Hampshire.

Claim.—"1st. Making the movable jaws with the parts extending beyond the joints, so as to be operated by the wedge, or its equivalent. 2d, Making both jaws movable so as to open equally, and hold the various sizes on a line with the centre of the whole tool."

13. For an *Improvement in Self-heating Smoothing Irons;* G. W. Bishup, Brooklyn, New York.

Claim.—"The tubes or pipes, placed one at the front, and the other at the back of the fire chamber or box, and the openings or holes at the sides of said chamber or box. Further, the hollow projection attached to the fire chamber or box, and communicating with said chamber or box, by an aperture, and having a tube connected with it, which communicates with the external air, at one side of the fire chamber or box."

14. For an *Improved Lubricator;* Abel Breaer, Saugatuck, Connecticut.

Claim.—"The attachment of the syringe directly to the plug of the cock."

15. For an *Improvement in Double Panel Shutters;* Charles S. Bruff, Baltimore, Md.

Claim.—"The combination of the double panel shutters, with the wire netting inserted between the panels, as an effectual bar against the admission of mosquitoes, or other insects, into buildings, and sparks and cinders in railroad cars, &c."

16. For an *Improvement in "Pegging Jacks," or Shoemakers' Head Blocks;* Thomas D. Bailey, Lowell, Mass.

Claim.—"1st, The method of fastening the turn-table to the block, by means of the screw and spring. 2d, The peculiar construction of the wedge, having a convenient handle-pawl attached to it, which pawl plays into a ratchet made in the turn-table or bed plate."

17. For an *Improvement in Machines for Paring Apples;* John D. Brown, Cincinnati, Ohio.

Claim.—"The projections on the impelling wheel frame, when the wheel is hung on a centre, within the circle of action of the projections, and sufficiently eccentric to the frame for the escape of one projection over the other."

18. For an *Improvement in Corn Planters;* Reinhold Boeklen, Jersey City, N. J.

Claim.—"The employment of one or more covering plates applied in connexion with the seed-box or tube, and the plunger, and operating to lift a quantity of earth, and deposit over the corn which has been planted."

19. For an *Improved Machine for Sawing Felloes;* S. and Wm. H. Book, Rushville, Ohio.

Claim.—"Hanging the saw, by means of adjustable arms, to a horizontal shaft or angle, thereby allowing the saw to descend by its weight through the circular path forming the curvature of the felly."

20. For an *Improved Mould Press for Horse Collars;* Melvin C. Chamberlain, Shelden, New York.

Claim.—"Giving shape and form to horse collars, by means of a mould press."

21. For an *Improvement in Processes for Making Paper from Straw;* Wm. Clark, Dayton, Ohio.

Claim.—"The boiling of coal tar in with the straw, or other vegetable material, for the manufacture of paper."

22. For an *Improved Hydrant;* C. J. Cowperthwaite, Philadelphia, Pennsylvania.

Claim.—"1st, The employment or use of the case or protector, so connected with the valve rod, that the valve will be opened when the case or protector is moved aside, to expose the nozzle; and the valve closed when the case or protector is moved over the nozzle. 2d, The slide valve, arranged or applied to the cistern; the valve being fitted within the cistern, and connected with the rod, through the waste water passage, whereby the valve is made to work water tight, and the use of a stuffing box and packing avoided. 3d, Securing the cistern, with the pipe and valve attached within the case, by means of a rod, whereby the above parts may be readily detached from the case, and secured within it."

23. For an *Improvement in Lard Lamps;* Samuel Davis, New Holland, Penn.

Claim.—"A tube, with a cone-shaped feeder and lard heater in, two segments, (to admit of a double wick,) with its apertures, and the aperture in the stem, all in combination."

24. For an *Improved Machine for Splitting Wood;* Charles Day, Lancaster, and Alanson D. Lord, Bethany, Assignors to Charles Day, Lancaster, New York.

Claim.—"The particular application of the axes."

25. For an *Improved Self-Regulating Wind-Mill;* Albert G. Field, Quincy, Illinois.

Claim.—"Hanging the sails on arbors, or spindles, and having the weights attached to the cranks of the arbors or spindles, by cords having buttons upon them. Further, raising the weights, by means of the cords attached to the weights and shaft, or pin."

26. For an *Improved Road Scraper;* John Gustine and I. M. Rankin, Lewiston, Ill.

Claim.—"The beam, sliding through bands upon the tongue, attached by the chains to the scraper, and operated and made fast by withdrawing or inserting the pin."

27. For an *Improvement in Potato Diggers;* Abram Hewlings, Philadelphia, Penn.

Claim.—"The combination of the excavator and inclined open bed, with the series of rakes, so connected with the endless carrier, that the rake-teeth will be projected to the front of the excavator, at, or nearly at, a right angle to its surface, and have a motion of translation along the bottom of the same, previous to reaching the inclined bed."

28. For a *Process for Preparing Elastic India Rubber Cloth;* Nathaniel Hayward, Colchester, Connecticut.

Claim.—"The producing an elastic fabric, of uniform strength, by uniting a sheet of rubber with sheets of cloth, thinly coated on one side with a vulcanized compound of rubber; the sheet of rubber before it is united with the sheets of cloth, being in the modes so prepared, that the central part of it is completely vulcanized, while the surfaces are not."

29. For an *Improvement in Bagasse Furnaces;* Abram Hager, Baton Rouge, and Youngs Allyn, New Orleans, Louisiana.

Claim.—"The application to bagasse furnaces, of a skeleton arch, which will retard the bagasse in falling direct on such portions of the fuel in a state of combustion, or in any other mode substantially the same, which will produce the same effect."

30. For an *Improvement in Salt Evaporators;* Benjamin Hood, Albany, New York, and E. P. Monroe, Charlestown, Massachusetts.

Claim.—"The construction of an evaporating apparatus, of two concentric rotary cylinders, supplied with liquid, heated and operated to effect evaporation from the weaker portion of the liquid, and economizing fuel."

31. For an *Improvement in Making Gum Elastic Cloth;* Henry G. Tyer, Ballard Vale, Mass., and John Helm, New Brunswick, N. J.; ante-dated January 9, 1856.

Claim.—"An elastic fabric, composed of two pieces of cloth, either woven with the threads of the weft in a diagonal position to the threads of the warp, or of common cloth, stretched, so as to force the threads in such relative diagonal position combined, and caused to adhere together, exclusively, by a vulcanized compound of india rubber or gutta-percha; the two pieces of cloth being first united by the vulcanized compound, and the compound being vulcanized after the union."

32. For an *Improvement in Manufacturing Felted Yarns;* Moses A. Johnson, Lowell, Massachusetts.

Claim.—"The arrangement of the steam rubber in relation to and in combination with the endless apron."

33. For an *Improvement in Dumping Scrapers;* Matthew S. Kahle, Lexington, Va.

Claim.—"So attaching the body of the scraper permanently to a but axle, supported in a pair of wheels, as that said body may be dumped and returned back to its original position, and ready for its next load, without stopping the horses, or changing their direction.

34. For an *Improvement in Washing Machines;* James T. King, City of New York.

Claim.—"The construction of a rotary cylinder in connexion with internal and external pipes, arranged in such a manner, that through said pipes steam can always be let into the lower part of the cylinder, and escape at the top, while the cylinder is in motion, or stationary; and that by the same arrangement, hot water, cold water, or steam can be let into the cylinder at the top, and escape at the bottom, while said cylinder is in motion or stationary."

35. For an *Improvement in Machines for Sowing Clover Seed;* Matthew S. Kahle, Lexington, Virginia.

Claim.—"In combination with a gathering and conveying apparatus such as described, the rubber and meshed wire concave, for separating and throwing out the grass, leaves, weeds, and other impurities from the heads, pods, &c., and passing the latter to the threshing cylinder, and concave, and blast, and screen underneath them."

36. For an *Improved Method of Hanging Gates, Doors, &c.;* Samuel Uberholyer, Terre Hill, Pennsylvania.

Claim.—"The arrangement of the pawl, and pawl holder, with each other, and with the levers, the ratchet wheel, the pinion, and the rack bar."

37. For an *Improvement in Furnaces for Smelting Iron;* Thomas H. Powers, Wyocena, Wisconsin.

Claim.—"So arranging the pipe in connexion with the combustion chamber and stock, that the air passing through the pipe shall be heated and discharged."

38. For an *Improvement in Cooking Apparatus;* George Pierce, City of New York.

Claim.—"The employment of the double oven, arranged and combined with the roasting apparatus."

39. For an *Improved Machine for Manufacturing Barrel Heads;* N. W. Robinson, Keesville, New York.

Claim.—"1st, The peculiar construction of the clamp, as herein shown and described, viz: said clamp being formed of a ring, having segments attached to its under side by set screws placed between the upper surface of the segments and under surface of the ring, by which construction the clamp may be enlarged or contracted so as to suit different sized barrel heads. 2d, I claim the stationary bed piece, and rotary planing disk, in combination with the sliding clamp, for the purpose of allowing said planing disk to plane and chamfer the whole surface of one side of the barrel head, and then support it in its position while being chamfered, and planed on the other side."

40. For an *Improved Machine for Extracting Stumps;* Solomon W. Ruggle, Fitchburgh, Massachusetts.

Claim.—"The lever frame, operated by the lever, pawls, ratchet, and strap, when the above parts are attached to the sled."

41. For an *Improvement in Extension Wagons;* Ephraim D. Rosencrantz, City of New York.

Claim.—"The employment of the slide bars, when used with the bars."

42. For an *Improvement in Compositions for Stuffing Leather;* John Rose, Newark, New Jersey.

Claim.—"Softening leather by stuffing it with a compound of paste, made of rye, or other meal, bees-wax, rosin, molasses, and oil, or other fatty matter."

43. For an *Improved Hoop Machine;* Joseph and Sylvester Sawyer, Fitchburgh, Mass.

Claim.—"1st, The combination of the rest and the pressure roll, with the hollow faced cutter head. 2d, The method of tapering the hoop for the lap by means of the lever and spring top."

44. For an *Improved Door Fastener;* Willard H. Smith, City of New York.

Claim.—"The use of the screw nut, working on the hinged stem as a means of adjustment of the plate, when employed in combination with the staple hook."

45. For an *Improvement in Heating Feed-water Apparatus for Steam Boilers;* Thos. Sloan, St. Louis, Missouri.

Claim.—"1st, A vessel separate from the boiler, but communicating both with the steam and water chambers thereof, in which the water, previously to its entrance to the boiler, is heated by passing in a thin stream in its upper part, and also by the contact of the steam with the top of the body of water contained therein. 2d, The arrangement of the purifying vessel, the pipe with its funnel-mouth, the internal heating chamber, and the pipes."

46. For an *Improvement in the Construction of Artificial Legs;* Wm. Selpho, City of New York.

Claim.—"The semi-cylindrical joints fitted with the pipe and pin, to connect said joints together, and give facility for lubricating the same. Also, in combination with said semi-cylindrical joints, the elastic cushion at the ankle joint. Also, attaching artificial toes of india rubber to the wooden part of the foot."

47. For an *Improvement in Machines for Sowing Seed Broad-Cast;* Enos Stimson, North Craftsbury, Vermont.

Claim.—"The rotating horizontal arm or tube, provided with valves at its ends, and used in connexion with the adjustable board or plate, provided with the semi-circular recesses."

48. For an *Improvement in the Ladling of Molten Glass;* Wm. P. Walter and Jacob Green, Philadelphia, Pennsylvania.

Claim.—"The employment of a suspended ladle for facilitating the manufacture of glass."

49. For an *Improvement in Marble Sawing Machines;* A. F. Ward, Louisville, Ky.

Claim.—"Suspending the saw frames or sashes within the frames, by means of the chains which are attached to rack bars, having weights or counterpoises connected to them, the rack bar being connected by pinions with rack bars, to which the connecting rods of the saw frames or sashes are attached."

50. For an *Improvement in Sheep Shears;* Robert M. Wilder, Coldwater, Michigan.

Claim.—"The rotary cutter, in combination with the spring handle, coupling rods, levers, spring pawls, spur wheel, and wheels connecting spur wheel with cutter wheel, or equivalents thereof.

51. For an *Improvement in Railroad Car Seats;* George Willard, Boston, Mass., Assignor to self, and W. C. Jameson, Antrim, New Hampshire.

Claim.—"The combination of the divergent mortises, or their equivalent, the guide groove and the projection as applied to the seat holder, and the journal, provided with a tenon, and arranged in a stand. Also, combining with supporting socket or stand, and the chair seat or chair, the lateral bearers and legs, each provided with feet."

52. For an *Improvement in Scythe Fastening;* Denison W. Green, Assignor to self, and Aretas Ferry, Bernardstown, Massachusetts.

Claim.—"The combination of the adjustable wedge and cam lever, as applied to the binding stirrup and snath."

53. For an *Improvement in Propellers for Life Boats;* George W. La Baw, Jersey City, N. J., Assignor to self, and Joseph Collon, City of New York, and T. Howell, Ewing Township, New Jersey.

Claim.—"Constructing the propellers with blades on both sides, so as to enable the boat to be worked by the same mechanism when either side up."

54. For an *Improved Saw-Mill Dog;* George W. Hill, Assignor to self, and Francis Lyons, Waverly, New York.

Claim.—"The peculiar form of the bail block, having a front and back rest or bearing in connexion with the arm, clasping the shaft of the screw. Also, the die or dies in connexion with the spring bar, the rest, and the guard."

55. For an *Improvement in the Manufacture of Machine Bricks;* S. W. Wood, Washinton, D. C.

Claim.—"Moulding brick by concussion, whether it be by this or any other mechanism."

56. For an *Improvement in Machinery for Felting Hat Bodies;* James S. Taylor, Danbury, Connecticut.

Claim.—"The vibrating rubber or bed, in combination with the rubber, having a positive movement or rotation on their own axis given them in a direction causing the outer points of their peripheries to travel in the direction of their general travel, as acquired by the rotation of the central shaft."

MAY 13.

57. For an *Improved Riffle for Gold Washing;* Ossian G. Auld and Jasper S. Whiting, Stockton, California.

Claim.—"The use of circular cavities or receptacles having the neck of one diameter, and the lower portion of an enlarged diameter."

58. For an *Improvement in Locks;* William H. Akins, Berkshire, New York.

Claim.—"1st, So arranging a series of revolving slotted disks upon a fixed neck or stud, that each, in turn, shall be made the means of adjusting the slot of the other, when operated upon by another disk secured to a revolving shaft and index. 2d, Altering the respective numbers of two or all the disks, by the simple change of an adjustable clutch from one hole to another. 3d, The method of discovering the proper numbers to open the lock."

59. For an *Improved Cartridge Opener;* Jesse S. Butterfield and Simeon Marshall, Philadelphia, Pennsylvania.

Claim.—"The combination of a steady pin, thumb-piece, toothed saw, and spring, attached to the upper band of the gun."

60. For an *Improved Farm Gate;* Charles N. Cole, Pleasant Valley, New York.

Claim.—"The arrangement and combination of the parts forming a self-acting or balance gate."

61. For an *Improvement in Wardrobe Trunks;* William J. M'Craken, Rochester, N. Y.

Claim.—"The construction and arrangement of the supporting strips in the portion of the trunk, for limiting the sliding portion of the wardrobe to the part of the trunk."

62. For an *Improved Planing Machine;* Cyrus B. Morse, Rhinebeck, New York.

Claim.—"1st, The combination of the following mechanical elements: planing cylinders. line plate, beds or rests, and weighted levers, when arranged and combined for reducing a board to an equal thickness, without bending the same. 2d, Making the edge of the bed a cutting instrument, and giving said bed or rest a longitudinal movement, simultaneous with the swinging back or forward of the cylinder, so that the edges of the cutters on the cylinder will preserve the same relative position, with respect to the cutting edge of the bed, in all positions which the said cylinder may occupy. 3d, Giving the line plate a tilting motion about its own axis, to present its flat surface to the board under all circumstances. 4th, Maintaining the pressure on the middle of the board, irrespective of the portion of the cutters to which the board is submitted, by means of the weighted levers."

63. For an *Improved File Cutting Machine;* James L. Norton, Alum Bank, Penna.

Claim.—"1st, Hanging the worm wheel shaft in movable bearings, so the worm may be disengaged from the feeding rack, without stopping its motion to do so, for the purpose of allowing the carriage to run back and be set for the next series of nicks. Also, in combination with the movable shaft, the adjustable projection and levers, for first holding and then disengaging the shaft. to admit of its swinging. Also, in combination with the sliding carriages, the projection and adjustable former, for keeping the blank at an uniform distance from the nicking tool, for the purpose of equalizing the force of the blow, notwithstanding the taper of the blank. Also, the use of the spaces for regulating the force of the spring upon the nicking tool."

64. For an *Improved Reacting Water Wheel;* George W. Pittock, John B. Stott, and Galen Richmond, Troy, New York.

Claim.—"The combination bucket, formed by the union of two separate buckets, whose lines are arranged so as to form a hollow box, through which the water passes in operating the wheel. Also, the mechanical arrangement and application of the gearing to the wheels and shaft within the upper section of the cone of the upper wheel, in combination with the cap which it covers."

65. For an *Improvement in Brooms and Brushes;* Thomas H. Powers, Wyocena, Wis.

Claim.—"The frame composed of links and rods, which surround the broom, and hold it in connexion with the cone."

66. For an *Improvement in Apparatus for Heating Buildings by Steam;* A. S. Pelton, Clinton, Connecticut.

Claim.—"The construction of the apparatus with annular chamber around the fire pot, and constituting a portion of the channel from the boiler to the radiator, for warming the air in the radiators, previous to the generation of steam."

67. For an *Improvement in Snow Ploughs for Railroads;* Samuel Richards, Philadelphia, Pennsylvania.

Claim.—"1st, The construction of a snow clearer, of a simple rising inclined plane, in combination with the curved pieces, so arranged, that the snow shall be gradually raised at or near to the surface of the surrounding snow, and then discharged over on the top of it. 2d, The employment of a series of pipes or other heating apparatus, in the interior of a snow-clearer, for the purpose of diminishing the adhesion of the snow to the upper surface of the clearer."

68. For an *Improvement in Making Brass Kettles;* Frederick J. Seymour, Waterbury, Connecticut.

Claim.—"Forming brass kettles or similar articles. from disks of metal, by the successive operations; commencing at the bottom and smaller part of said kettle, and shaping the same at once, and then gradually forming a drawing in the sides, by means of dies."

69. For an *Improvement in Gas Ovens;* John Starrett and Newton J. Wier, Lowell, Massachusetts.

Claim.—"1st, The distributor plate. 2d, The combination of the distributor plate, the chamber with its net-work and covering, and the exterior cases. 3d, The combination of the plates or registers with the net-work covering of the chamber, for the purpose of varying the surface of combustion, to suit the various utensils to be heated."

70. For an *Improvement in Machines for Preparing Dough for Moulding Crackers;* Francis C. Treadwell, Jr., City of New York.

Claim.—"The use of the cutters in combination with the throat, for the purpose of making a shear cut, when used in combination with the grooved rollers."

71. For an *Improvement in Chairs for Ships' Cabins;* William Thomas, Hingham, Massachusetts.

Claim.—"Suspending or attaching the chair to the curved bar, which is connected to the base by means of the arms and curved bar."

72. For a *Fire and Escape Ladder;* John Van Amringe, Cincinnati, Ohio.

Claim.—"The combination of the ladder, frame, and guy chains, as attached to the frame work—and these in combination with the pulley and rope, for elevating the *latter* and frame. Also, the arrangement of the guiding shafts, arranged with the two sections of the framing and the windlass, and the cord connected therewith, and to one of said sections, for drawing the two sections apart and together."

73. For an *Improved Furnace for Heating Soldering Irons;* James Wilson, Brandywine, Delaware.

Claim.—"Constructing a furnace, and providing it with any desirable number of cells, for the purpose of heating soldering irons with anthracite or other coal."

74. For an *Improved Horse Shoe;* Nelson B. Carpenter, City of New York.

Claim.—"A horse shoe, having a branch bar attached to each heel bar of the shoe, extending inwardly, and at the same time lapping and fitting one to the other, with corresponding apertures through each, for the insertion of a pin or screw."

75. For an *Improvement in Surgical Splint;* John Clough and Daniel M. Cummings, Enfield, New Hampshire.

Claim.—"1st, The bed, composed of strips of cotton cloth, or other suitable material, passing through slots in the leg side piece. 2d, The foot frame and bed, composed of the oblique standards, the bow and the strip of cloth, or other suitable material, passing through the slots attached to, and adjustable upon the leg side pieces. 3d, The device for extending the leg by the employment of the lower extension screw, the traversing nuts and their guides, with their connecting straps, in combination with the cross bars, the leg side pieces, the femur side pieces, the femur splint, the cushions, the bolster, the bandages with their connecting straps, and the brass straps. 4th, The device for extending the thigh, by the employment of the upper extension screws, in combination with the femur side pieces, by the leg side pieces, the femur splint, the cushions, the bolster, the bandages, with their connecting straps and the brass straps. 5th, The device for flexing and extending the limb, by the employment of the elevating screw and its supports, in combination with the cross-bar, the leg side pieces, the femur side pieces, the supports, the braces, the elongating arbor, the concave flooring, and the bed pieces. 6th, The elongated arbor. 7th, The device for spreading and contracting the splint, by the employment of the elongated tenon passing through corresponding mortises in the lower ends of the bed pieces, in the double elongated tenons firmly fixed in the upper ends of the bed pieces; and passing through a corresponding mortise in the upper end of the bed piece and the confining pin, in combination with the bed pieces, and the supports, and the braces, the elongating arbor, the femur side pieces, the leg side pieces, and the cross-bars."

76. For an *Improvement in Continuous Sheet Metal Lathing Surface;* John B. Cornell, City of New York.

Claim.—"A continuous sheet metal lap surface formed of united strips or sections."

77. For a *Machine for Cutting Green Corn from the Cobs;* William B. Coates, Philadelphia, Pennsylvania.

Claim.—"The spindle, with any convenient number of prongs, in combination with the yielding cutters."

78. For an *Improvement in Bridle Bits;* Benjamin J. Day, Gibson County, Ind.

Claim.—"The screw, the spring folding limb, by which the common curb and lever bit, and the non-curb and lever bit can be changed at pleasure from one to the other."

79. For a *Self-Counting Measure;* Elisha Dexter, Holmes' Hole, Mass.

Claim.—"Supplying the point which marks the extremity of the yard or standard of measure with the pressure knob, and connecting it with the pointer by means of the escapement lever and the rack, as a means of pointing out the number of yards measured upon the index."

80. For an *Improvement in Machinery for Trebling Single Thread;* Lucius Dimock, Hebron, and Ira Dimock, Mansfield, Connecticut.

Claim.—"1st, The rock shaft, with a hollow conducting arm, operating to conduct each strand of the thread from its bobbin, to the hitching pin, and to effect the enchaining of the loops. 2d, The attachment of the hitching pin or pins to the arm or arms of a rock shaft, which is operated for the purpose of forming, and disengaging the loops. 3d, The arrangement and combination of the rock shaft, having a hollow conducting arm or arms, the traveling carriage carrying the rock shaft, and its vibrating hitching arms, the strand bobbins, and the trebled thread spools."

81. For an *Improvement in Machines for Dressing Mill Stones;* Simon W. Draper, South Dedham, and Reuben M. Draper, Roxborough, Massachusetts.

Claim.—"In combination with the inversion of cam, the employment of a secondary lever, attached to the sliding piece, or arranged in any equivalent manner, to cross the face of the cam, on one side of the centre, and transmit motion therefrom to an arm on the pick shaft, whereby, in all changes of the relative positions of the pick shaft and the cam, the pick is operated by the cam in such a manner as to give an uniform force to the blow."

82. For an *Improved Bow for Violins;* Samuel F. French, Franklin, Vermont.

Claim.—"The attachment of a portion of the hair of the bow to a movable pin, operating to separate the said portion of the hair from the main body of hair in the bow, to unite it therewith, at the pleasure of the player."

83. For an *Improvement in Self-raking Attachments to Harvesters;* Hugh Foresman, Enon, Ohio.

Claim.—"The combination of the wheel, adjustable crank, slotted rake, and guides or ways, for giving the rake its traversing and rising and falling motion."

84. For an *Improvement in Hat Felting Machines;* A. C. Fuller, Danbury, Conn.

Claim.—"The polygonal drum."

85. For an *Improved Hand Saw;* Jackson Gorham, Bairdstown, Georgia.

Claim.—"The construction of a saw, so as to answer the purpose of both saw and square, in one and the same instrument."

86. For an *Improved Husking Thimble;* J. H. Gould, Smith, Ohio.

Claim.—"The device resembling the end of a human finger, and formed by providing a thimble, very simple in construction to a sewing thimble, and welding or otherwise forming an artificial finger-nail, on the upper side of its forward extremity."

87. For an *Improvement in Winnowing Mills;* Horace N. Goodrich, Aurora, Ill.

Claim.—"The arrangement of the screen, above the ordinary screens and shoes of a common farming mill, and furnishing a regulated blast to said series of screens, either from the main fan wheel, or an auxiliary wheel near thereto, for the purpose of comprising within one machine or frame, the facilities of cleaning all kinds of grain or seeds, and separating them from each other, and from the impurities mixed with them."

88. For an *Improved Punching Machine;* Edward Heath, Fowlersville, New York.

Claim.—"Placing a series of punches of varying sizes and forms, in a flanched rotating cylinder, arranged relatively with the plunger rod, so that by rotating the cylinder, either of the punches may be brought in line and connected with the plunger rod."

89. For a *Fastening for Port-monnaies and Pocket Books;* James Hewson, Newark, New Jersey.

Claim.—"The combination of the catch or swivel, the spring with the ring attached to the port-monnaies or pocket book frame."

90. For an *Improvement in Lock Joint for Railroad Cars;* James R. Hilliard, Paterson, New Jersey.

Claim.—"The combination of the several laps, consisting of, 1st, The lapping each against the other, along a central, longitudinal, vertical plane, or nearly so; 2d, Lapping each on to or under the other, on planes parallel or nearly so, with the longitudinal axis of the rail; and, 3d, Making the surfaces where each lap on and under the other, inclining downwards from each side of the rail, towards the central longitudinal vertical plane of division of the joints."

91. For *Improved Machinery for Manufacturing Washboards;* I. B. Holmes, Cincinnati, Ohio.

Claim.—"The arrangements of the cams, spring, and ring, for operating incising knife or cutter. Also, the arrangement of the guide piece and gauge piece."

92. For an *Improvement in Compound Rail for Railroads;* William J. Holman, Indianapolis, Indiana.

Claim.—"The extension at sundry points throughout its length or lengths, by waved or irregular formation of the stem or flanch of the cap bar of the tripartite rail, below and through or beyond the bottom surface of the two side or chair rails, and in connexion and combination therewith by a key, or wedge, passing through the one rail only, from below."

93. For an *Improved Method of Securing Knives to Cutter Heads;* William D. Hooker, Dedham, Massachusetts.

Claim.—"The cutter head, the shanks of the cutters, the wedge, the screw-rod—the whole in combination."

94. For an *Improvement in Invalid Chairs;* Daniel W. James, New Market, Va.

Claim.—"The construction of invalid chairs of a loosely jointed frame, in combination with a brace."

95. For an *Improvement in Mowing Machines;* C. M. Lufkin, Ackworth, N. H.

Claim.—"The employment or use of the endless aprons, in connexion with the rotating cutters."

96. For an *Improvement in Fastening Bits;* Horace Lettington, Norwich, N. Y.

Claim.—"The rod or arbor, passing transversely through the stock or bit, a portion of the socket, the rod or arbor having a notch in one side, and the shank of the notch also having a notch in one side, and the rod having a bolt passing against it."

97. For an *Improvement in Portable Chairs;* Zebulon Lyford, Lowell, Mass.

Claim.—"The self-operating folding portable chairs, or its mechanical equivalent."

98. For an *Improvement in Working Sheet Metal;* Sylvester B. Miller and Ezra W. Whitehead, Newark, New Jersey.

Claim.—"The employment of the die, when constructed and used in connexion with the lower die, for extending or stretching thin metal plate by pressure and rotary motion combined."

99. For an *Improvement in Brick Machines;* Edmund Kingsland, City of New York.

Claim.—"1st, The oscillating finisher, provided with a pair of fixed, and a pair of movable bearings, and operating in combination with a mould cylinder containing flat faced moulds, for the purpose of finishing the bricks with flat outer surfaces. 2d, The employment for varying the depth of all the moulds simultaneously, to vary the thickness of the bricks of the two cones, the right and left-handed screw shaft, operating in combination with the inclined edges on the piston bars."

100. For an *Improvement in Blow Pipes;* Oliver L. Lawson, Crestline, Ohio.

Claim.—"In combination with the adjustable valve in the cylinder, the adjustables E, in the tube D, so that a regulated blast may be had, whether sharp or mild."

101. For an *Improvement in Gas Regulators;* Henry Waterman, Hudson, New York.

Claim.—"The construction of the valve of the gas regulators, in the annular or ring form, with two faces or leats of different diameter; one at the outer, and one at the inner periphery or edge, so as to produce greater circumferential capacity or opening for discharge of gas, with a limited area of valve relatively."

102. For an *Improvement in Seeding Machines;* Hosea Willard, Vergennes, Vt.

Claim.—"The rotating cylindrical frames or screens, in combination with the inclined board or plate, with pivoted cleats attached for the purpose of distributing the seed, and the cylinders or rollers having teeth or shares attached to their peripheries."

103. For an *Improvement in Ovens for Cooking Ranges;* Jacob S. Williams, St. Louis, Missouri.

Claim.—"The employment of removable ovens, provided with unconnected compartments of various sizes and forms, and arranged so that said ovens may be substituted one for another, or be inserted in different portions, for the purpose of subjecting their compartments to different intensities of heat, according to the nature of the viands to be cooked thereon."

104. For an *Improvement in Locks;* Joseph M. Lippincott, Pittsburgh, Pa.

Claim.—"The combination of the spring bolt, tumblers and fence, together with the combination therewith of the locking-bolt and latch-bolt, so that the lock may be readily opened from inside, without a key, and yet requiring a key to open it from the outside."

105. For an *Improvement in Rolling File Blanks;* James N. Aspinwall, Assignor to self and Henry E. Staff, Newark, New Jersey.

Claim.—"The use of the rollers for forming file blanks, when said rollers are operated and adjusted by the slide, cam, and spring."

106. For an *Improvement in Mowing Machines;* Jonathan F. Barrett, North Granville, N. Y., Assignor to Abram B. and Jonathan R. Barrett, Lincoln, N. C.

Claim.—"The combination of guard plates, covering plates, and saw connexion to pinion, whereby the driving mechanism is effectually excluded from foreign matter."

107. For an *Improved Cutter Head for Lathes;* Milton Roberts, Assignor to self and Isaac N. Felch, Belfast, Maine.

Claim.—"The eccentric insertion of the tenon of the cutter-head in the mandrel; to produce an eccentric motion in throwing out the edge of the cutter."

108. For an *Improvement in Frames for Traveling Bags and Mail Pouches;* Samuel D. Quimby, Winchester, Assignor to Edward A. Locke, Boston, Massachusetts.

Claim.—"The improved mouth frame or combinations of two folding side frames, and two hinge extenders and gore closers, arranged, connected, and made to operate together."

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109. For an *Improvement in Machines for Cutting Meat;* Gustavus V. Brecht, St. Louis, Missouri.

Claim.—"The roller, as constructed of a series of circular plates having teeth or hooks on their peripheries—when said plates are put on a twisted square shaft—thus making rows of teeth of the edges of the several plates, and by the twist of the shaft, giving them a spiral form."

110. For an *Improvement in Water Closets;* Edward Bookhout and Chas. Hewlett, City of New York.

Claim.—"1st, A bowl, having the forward and backward motions, by means of the said bowl and waste working on a shaft or arms. 2d, The use of the pan, in combination with a movable bowl."

111. For an *Improved Boat Framer;* James Beetle, New Bedford, Mass.

Claim.—"The boat framer, as composed of the sets of adjustable and extension bars, and connecting contrivances, viz: the keel rests, bars, and their screws."

112. For an *Improvement in Pill Machines;* Henry C. Chapman, Albany, N. York.

Claim.—"The feeding cylinder, the knife, and the grooved bed piece, and the two grooved cylinders, having their surfaces driven at different rates of speed."

113. For an *Improvement in Fire Arms;* Samuel Colt, Hartford, Connecticut; patented in England, March 3, 1853.

Claim.—"Combining with the driving pin or bolt, and with the series of diagonal and longitudinal grooves, for rotating the breech and holding each chamber in line, during the discharge, the series of short longitudinal grooves, for locking the rotating breech, so that the hammer can rest on the solid metal between two chambers, instead of the nipple, to prevent accidental discharges. Also, in combination with the said driving pin or bolt and the series of longitudinal and diagonal grooves, the lateral grooves or inclined planes, to admit of turning the breech by hand, when the hammer is at half cock."

114. For an *Improved Arrangement of Supplemental Valves for High-pressure Steam Engines;* Richard Colburn and L. W. Hanson, Norwich, Conn.

Claim.—"The self-acting valves connected together, for the purpose of freeing the cylinder of water, and of back steam."

115. For an *Improved Printing Machine;* John H. Cooper, Philadelphia, Penna.

Claim.—"In combination with a type wheel, having its types radially arranged thereon and operated, the presser bar, for carrying the paper to the type, to receive the impression. Also, the manner of connecting and disconnecting the paper carriage and endless belt, together with the spacing of the lines, by means of the points, ratchet wheels, brace, and its projecting piece, so that the belt may run in one continuous direction, whilst the paper carriage may be traversed back and forth."

116. For an *Improvement in Annealing Furnace;* J. Joseph Eagleton, City of N. Y.

Claim.—"Charging and discharging an annealing furnace in bulk."

117. For an *Improved Method of Operating Saw-Mill Blocks;* Bela Gardner, Florence, Massachusetts.

Claim.—"Operating or adjusting the blocks of saw-mill carriages by means of the screw, endless chain, and shaft, in combination with the pinions and clutches."

118. For an *Oracular Wheel or Centre Table;* William O. George, Richmond, Virginia.

Claim.—"The said table, called the oracular wheel, or unique centre table, in combination with the game of equality, together with the checks. Also, in regard to these their application to this particular way, and for the particular purpose, and the method or arrangement of them, in combination with the table and game, by which particular effects are produced, or certain results arrived at."

119. For an *Improvement in Artificial Decoloring Compounds;* Francis Gerau, City of New York.

Claim.—"The use of phosphate of lime, precipitated out of a solution in muriatic acid, as an ingredient in a compound of materials, for the manufacture of a decolorating coal, which other materials may be varied, according to circumstances."

120. For an *Improved Swing Bolt for Fastening Shutters;* John Gunner, Jr., City of New York.

Claim.—"The use of the bolt, lever, and hub, operating in connexion with the catch plate, when the same is cast with a channel."

121. For an *Improvement in Gas Retort Fastening;* John G. Hock, Newark, N. J.

Claim.—"The attachment of the bail to the retort, or other mouth, by means of the hook headed bolts."

122. For an *Improved Shingle Machine;* Edward Hedley, Shelby, New York.

Claim.—"The formation of the endless feeding bed of beveled slots, so as to give the required taper to the shingle, as it passes beneath the knives of the revolving cams."

123. For an *Improved Horse Shoe;* John Henderson, Elmira, New York.

Claim.—"Arranging a special bearing surface, adapted to the rim of the hoof, and terminating in lines converging from the outer to the inner edge of the shoe upon the bars, with a gradual reflection of the heel, beginning at the converging lines, and extending to the near parts of the shoe."

124. For an *Improvement in Telegraphs;* David E. Hughes, Louisville, Kentucky.

Claim.—"1st, The holding in place of the attractive power of electro or natural magnetism, as applied to telegraphic purposes. 2d, Combining with a permanent magnet an adjustable spring, almost sufficient to sever it from its contact with the soft iron of the electro-magnet, and a lever, or its equivalent, which, after the permanent magnet has been separated from the iron by the action of a current, shall bring it back again into renewed contact, by the action of the power which has been called into action by the retreat of the magnet. 3d, The employment of two cog wheels or circuit breakers at each station, so arranged, that one shall be in connexion with the electro-magnet at the same station, and the other, in connexion with the transmitting cylinder at that station, the whole being arranged so that the connexion alternates at each station, for every letter between the electro-magnet and the transmitting cylinder at that station, in such manner, that the thorough connexion is always simultaneously through the transmitting cylinder of one station and the electro-magnet of the other station, whereby the machine at each station can at the same time be transmitting a message and receiving a message. 4th, So arranging a bolt and operating the same, by a cam or its equivalent, that it shall act upon a wheel attached to the shaft of the type wheel, so as to preclude the intelligence from one station being communicated to any other station or stations on the circuit on which it is desired to withhold the communication. 5th, The employment of a vibrating spring, properly weighted at its extremity, if necessary, and so arranged by a series of mechanism as to govern and regulate the movement of the type wheel. This, I claim, also, as a governor in other machinery, without limiting its use to its connexion with electro-magnetism. 6th, Printing by electro-magnetism, by a continuously moving type wheel, printing while in motion. 7th, The arrangement of a cylinder with pins spirally arranged thereon, to operate by contact with metallic points to close and break the circuit, when this combined with the systems of keys and catches, so arranged, that any desired point may be thrown into a position where it will be retained until it is struck by its corresponding pin."

125. For an *Improved Method of Regulating Wind-Mills;* Morgan S. Johnson, Palatine, Illinois.

Claim.—"The particular mechanical devices, so arranged for the purpose of housing the sails."

126. For an *Improved Printing Machine;* John M. Jones, Palmyra, New York.

Claim.—"The manner of attaching the lever to the wheel, so that the same may turn said wheel, while its fulcrum rests upon a fixed plate, situated below the revolving wheel, allowing at the same time, a revolving motion and a motion in the direction of its axis to the wheel, said lever being connected with the mechanism, by the rod passing through the hollow shaft of the wheel. Also, The arrangement and use of the lever, for the purpose of pressing down the type on the paper, when an impression is to be made, and at the same time insure always the right position of the type and wheel. Also, the swinging wheel attached to a hollow shaft, having projections on its periphery, corresponding in number and thickness to the type, for the purpose of moving the carriage with the paper attached, the exact distance necessary for printing one letter after the other."

127. For an *Improvement in Feathering Paddle Wheels;* Harvey Lull, Hoboken, New Jersey.

Claim.—"Imparting to the paddles of paddle wheels, a rotary motion on their axis, whilst revolving about the axis of the paddle wheel, by means of an eccentric cog wheel, combined with and engaging the cogs of the pinions on the shaft of the paddles, the form of which pinions is generated."

128. For an *Improved Water Metre;* Nathan B. Marsh, Cincinnati, Ohio.

Claim.—"1st, The manner of pinching the diaphragm between the plates, so as to perfectly and at all times pack the joint between the chambers which it divides, viz: by means of the projecting flanches on each lapping past each other, and the nuts to hold them together. 2d, The double reversing valve movement, namely, the two solid cylindrical valves, having their spindles connected by a rocking beam, playing within tubes, communicating at their ends with the supply and discharge, respectively, and with the respective compartments of the measuring cylinder, by means of apertures in their sides."

129. For an *Improved Hydraulic Engine;* Augustin Miller, Grafton, Virginia.

Claim.—"The combination of the cut-off motion with the relief pipes, for the purpose of cutting off the stroke at any desired stage, without being compelled to waste the power, by working the piston against atmospheric pressure."

130. For an *Improvement in Surface Condensers for Steam Engines;* James M. Miller, City of New York.

Claim.—"Passing the water of condensation in or upon the main body of the condensing surfaces, on its way to the boiler, under the pressure of the steam and the cold external water on the other portion of the surface."

131. For an *Improvement in the Construction of Gas Generators;* Max Pettenkofer and Charles Ruland, Munich, Bavaria; patented in Bavaria, Feb. 24, 1851.

Claim.—"The construction and arrangement of the many chambered regenerators, for making gas from wood or vegetable fibre, whereby the primitive vapors of destructive distillation of wood or vegetable fibre, are progressively treated up beyond the heat in the retort."

132. For an *Improvement in Devices for Setting Artificial Teeth;* William G. Oliver and Thomas Harrison, Buffalo, New York.

Claim.—"Making the teeth with grooves in their cheeks, and attaching them to the plate by fusible metal cast into said grooves. Also, making the plate, and attaching the teeth at one operation by casting."

133. For an *Improved Elevator for Cotton, Sugar Cane, &c.;* E. Price, Waterproof, Louisiana.

Claim.—"The arrangement of the table with the carrier apparatus."

134. For an *Improved Floating Drawbridge;* Napoleon B. Proctor, Burlington, Vt.

Claim.—"The construction of a floating drawbridge, by erecting a wharf or dock, on each side of or partly or wholly within rivers or other waters, over or across which such bridge may be required, with a slip in one of said docks or wharves, of a suitable size for the reception of a boat of proper dimensions, viz: nearly as wide as the slip, and about twice the length of the open space between the docks or wharves, (through which open space vessels may pass and repass,) which boat, by steam or other power, can be readily worked forward to the opposite dock or wharf, and thus form a connexion therewith, and back again into the slip, leaving the space or channel open for the passage and repassage of vessels."

135. For an *Improved Method of Hanging Reciprocating Saws;* John Robingson, New Brighton, Pennsylvania.

Claim.—"Attaching the upper end of the saw to the pendent or arm, which is connected to the upper frame, and the lower end of the saw to the pitman, just above the point of connexion of said pitman with the lower frame."

136. For an *Improved Carriage Shaft Coupling;* James D. Sauren, Columbia, Tenn.

Claim.—"The employment upon couplings for carriage shafts or tongues, which consists in enlarging the journal of the shaft iron in the centre, so as to form a globular ellipsoidal or double conical bearing surface, and clamping the same between the clip irons, countersunk, by means of screws or other equivalent devices, so that the wear is entirely upon the enlarged surface, and all lateral play and rattling of the clip irons are prevented. Also, in combination therewith, the leather packing, for the purpose of retaining the lubricating material."

137. For an *Improvement in Surface Condensers for Steam Engines;* Nathan Thompson, Jr., Williamsburgh, New York.

Claim.—"1st, An elastic junction of a tube with a tube sheet, composed of a thimble on a tube sheet, and a short piece of elastic tubing applied thereto, and to a tube end or a collar on a set of tubes. 2d, Uniting firmly several small tubes into a collar, which latter is attached to a tube sheet, by means of a slip or elastic joint, whereby several tubes require only a single stuffing box or elastic junction, in order to compensate for their expansion and contraction. 3d, In conjunction with an elastic junction, metallic clamping rings, or their equivalents."

138. For an *Improvement in Excavating Scoops;* John Taggart, Roxbury, Mass.

Claim.—Applying one or two discharges within a pair of scoops, so as to operate therewith or to be operated thereby."

139. For an *Improvement in Lining Metal Pipes with Gutta-Percha;* A. D. Puffer, Somerville, Mass.

Claim.—"The method of lining metallic pipes with gutta-percha, the pipe being drawn down upon the lining."

140. For an *Improvement in Ash Leaching Apparatus;* Philip Perdew and Alexander Brinkerhoff, Sycamore, Ohio.

Claim.—"The mechanical arrangement and combination of the metallic pen and reservoir with the tube and the wooden screen."

141. For an *Improvement in Gas Retort Cleaners;* Samuel H. and Matthew C. Walker, Lancaster, Pennsylvania.

Claim.—"Providing the retort with a receptacle below its bottom, and applying in connexion therewith a scraper, to scrape the residuum from the bottom of the retort into the said receptacle, without suspending the operation of the retort."

142. For an *Improved Music Rack;* Thomas Ward, Birmingham, Pennsylvania.

Claim.—"The jointed or adjustable bar, the bar provided with the blade, and attached to the sliding bars by the sliding springs, the bar having a plate attached to it provided with a spring—the above parts being fitted in a frame, which is allowed to fold or be turned in a vertical or horizontal position."

143. For an *Improved Saw Set;* Edward S. Watson, Chenango Falls, New York.

Claim.—"The arrangement of the side set screw, and the bed for the saw plate, and the central adjusting screw, for giving to the bed and the saw blade the inclined position, and thus allowing the tooth of the saw to have given to it the curved or twisted face."

144. For an *Improved Mode of Extracting Stumps;* George W. Zeigler, Tiffin, and Manasseh Grover, Sandusky, Ohio.

Claim.—"Utilizing the weight of tree while falling, for extracting its stump, by the combination of chains and hooks, and adjuster."

145. For an *Improvement in Working in Sheet Metal;* J. B. Holmes, Cincinnati, O.

Claim.—"The use of corrugated plates, operating in connexion with the eccentric bending and gauging shafts."

146. For an *Improved Weighing Cart;* James W. Martin, Assignor to Lewis Rotherwell and James Martin, Burlington, New Jersey.

Claim.—"The levers, constructed with the scale beam, in combination with the bar."

147. For an *Improvement in Ventilating Registers and Dampers for Stoves;* John Magee, Lawrence, Assignor to self and William J. Towne, Newton, Mass.

Claim.—"Combining with or arranging in the flue pipe, when the flue is constructed, (viz: with two discharge pipes,) a rectangular box or chamber formed with an opening, and so as to receive within it and permit to operate, a rectangular valve and damper."

148. For an *Improvement in Machinery for Making Rope and Cordage;* William R. Dutcher, Assignor (by intermediate transfer) to Harvey Church, Troy, N. York.

Claim.—"1st, The arrangement of the gear wheels, pinions, plate, and ring, for sustaining and revolving the creel shafts. 2d, The adjustable friction wire or cord, passing around in the disks of the circular ranges of bobbins, thereby simultaneously regulating all the yarns in each range to precisely the same tension. 3d, The adjustable tube over the centre of the lay-up block, for the purpose of regulating, by its proximity to said lay-up block, the tension of the various yarns composing the strands. 4th, The construction of the lay-up cap on the end of the shaft fitted to receive the movable cone and adjustable tube, so that the tube and cone can be conveniently changed, to adapt the parts to laying-up different sized rope or cordage. 5th, Leading the yarn off from the bobbins, to a hole or guide on the arms, or their equivalents ,on the opposite side, or nearly so, of the circular ranges of bobbins in the creel."

149. For an *Improved Lathe Attachment for Turning Irregular Forms;* Milton Roberts, Assignor to self, Isaac Roberts, and Isaac N. Felch, Belfast, Maine.

Claim.—"Automatic lathe attachment for turning figured wood work, substantially a transverse and longitudinal movement, produced by cranks and inclined planes, or their equivalents."

150. For an *Improvement in Locomotive and Railroad Lamps;* John Stuber, Assignor to John Carton, Utica, New York.

Claim.—"The tubed structure as combined with the burner, to regulate the flow of air to the exterior of the flame of the lamp. Also, the arrangement of the feeding cup and the tube, provided with the regulating spirally grooved fillet."

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151. For an *Improved Method of Operating Head Blocks of Saw Mills;* Lucius B. Adams, Smithfield, Pennsylvania.

Claim.—"The lever, with pawl attached, and lever or arm, having a roller at its lower end, and the incline attached to the flooring, and operating in connexion with the ratchet, pinion, and racks."

152. For an *Improvement in Operating Steam Stamps;* William Ball, Chicopee, Massachusetts.

Claim.—" Stopping the operation of the stamps, whenever the piston is allowed to descend to a certain point, by the neglect to feed the material to the mortar in time."

153. For an *Improved Car Window;* James Butler, New Bedford, Mass.

Claim.—" Combining with the movable window frame and its socket frame or opening, four bolts and four sets of socket holes or bars provided with such holes—the whole being arranged so as to operate together. Also, combining with the window frame and its socket frame or opening, made in the side of the carriage, two sets of hinged arms, applied to opposite sides of the frame."

154. For an *Improvement in Photographic Pictures on Glass;* Albert Bisbee, Columbus, Ohio, and Y. Day, Nashville, Tennessee.

Claim.—" Making the border of the picture transparent, and placing the mat back of the picture."

155. For an *Improvement in Brick Machines;* Martin and James H. Buck and Francis A. Cushman, Lebanon, New Hampshire.

Claim.—" Connecting the plunger with the block or mould clearer, by means of the rods, having the racks on their lower parts, which racks gear into the part pinions on the shaft, whereby the plunger is allowed to rise more rapidly than the mould clearers."

156. For an *Improvmeent in Attachments for Piano Legs;* William Clark, City of New York.

Claim.—" Securing the metallic connexions for attaching legs to pianos, or other articles, into the respective parts of the leg and bed, by means of diagonal dowels, taking recesses in the sides of said metallic connexions."

157. For an *Improvement in Breech Loading Fire Arms;* Nathan S. Clement, Worcester, Massachusetts.

Claim.—" Rubber packing, or that material which is substantially the same, in connexion with breech loading fire arms."

158. For an *Improvement in Grinding Circular Saws;* William Clemson, East Woburn, Massachusetts.

Claim.—" 1st, The combination of the roll with the grindstone. 2d, The use of the flat pivot, for the purpose of enabling the stone to operate upon the entire surface of the saw."

159. For an *Improvement in Boot Trees;* Charles T. Eames, Milford, Mass.

Claim.—" The arrangement or mode of applying a simple cam and inclined plane, with respect to the foot and leg portions of the boot-tree, whereby the said devices are made to first perform the function of setting the foot parts of the tree firmly into the foot of the boot; and, next, that of stretching the leg of the boot, the application of stretching mechanism directly to the upper part of the leg of the tree being rendered unnecessary."

160. For an *Improved Mode of Constructing Portable Houses;* Daniel Fitzgerald, City of New York."

Claim.—" 1st, The constructing houses of staves, held together by hoops. 2d, Combining the staves in segments or parts of the periphery, some of which shall combine the doors and windows, to facilitate the putting up and taking down. 3d, Constructing the floors in segments. 4th, Sustaining the thrust of the roof by a hoop, which also confines the staves."

161. For an *Improvement in Securing Nuts to Carriage Axles;* Kingston Goddard, Philadelphia, Pennsylvania.

Claim.—" The method of securing screw nuts on axles, by combining with the nut a spring friction brake, to act on the thread of the screw by the tension of the spring—the lever or arm of the said brake, being made to extend beyond one of the faces of the nut, that the brake may be withdrawn from the thread of the screw, by the act of putting on the screw-wrench, to take off or put on the nut."

162. For an *Improved Engine Governor for Side-wheel Ocean Steamers;* Wm. B. Godfrey, Auburn, Iowa.

Claim.—"The employment in connexion with a propelling paddle-wheel, of a second paddle, which herein turned the governing wheel, fitted loosely to the same shaft, and having applied to it springs to control its position, relatively to the propelling wheel, when the wheel is out of the water, or not in motion; and being connected with a lever, or its equivalent, which works on a fulcrum, secured to the propelling wheel, and which is connected with the throttle valve or cut-off in such a manner, that when the propelling wheel is out of water, or not in motion, the governor wheel will close the throttle valve or cut-off—but when it is in operation in the water, the resistance of the water to the paddles of the governor wheel, will cause the said wheel to move relatively to the paddle-wheel, and by that means, give the throttle valve or cut-off more or less opening."

163. For an *Improvement in Reed Musical Instruments;* Emmons Hamlin, Assignor to self, and Henry Mason, Boston, Mass.

Claim.—"The construction of a rigid or non-elastic wind chest with the ordinary expanding wind chest connected together. Also, the peculiar construction and arrangement of the coupler, consisting essentially of the tongue interposed between the lever and the key."

164. For an *Improvement in Cases for Sewing Machines;* William O. Grover, Boston, Massachusetts.

Claim.—"Arranging a box or case for a sewing machine, so that when open, the box shall constitute the bed for the machine to be operated upon; and hanging the machine thereto, to facilitate oiling, cleansing, and repairs, without removing it from the box, and the peculiar adaptation of the handle, so that it may be pushed out when required to drive the machine, and when returned within the box, shall serve to prevent motion of the parts, whilst the machine is being transported."

165. For an *Improved Guard for Circular Saws;* Henry Gross, Tiffin, Ohio.

Claim.—"The mechanical construction and arrangement of the circular saw guard, to wit: The whole, in combination, as a useful and novel invention, to protect the workman from injury while working the saw, thereby keeping his hands and person away from the saw teeth, and also preventing injury to him, by keeping down the ends of the plank or stick, while the saw is passing through it."

166. For an *Improved Lock and Key;* Ezekiel M. Hendrickson, Brooklyn, N. Y.

Claim.—"1st, The construction and use of the key, which spontaneously projects slender arms through a revolving cylinder, for the purpose of simultaneously detaching catches from the bolts. 2d, The combination of the key, or the mechanical equivalent thereof, with the revolving cylinder, the check levers, the locking lever, and the springs."

167. For an *Improvement in Floats for Steam Boilers;* F. A. Hoyt, Boston, Mass.

Claim.—"Charging the float with compressed air."

168. For an *Improvement in Machines for Sizing Hat Bodies;* Samuel C. Ketchum, Brooklyn, New York.

Claim.—"The use of the combination of the elastic shell (upon the revolving drum or cylinder), with the vibratory rubber case surrounding the same."

169. For an *Improvement in Mowing Machines;* William F. Ketchum, Buffalo, New York.

Claim.—"Attaching, any where between the shoes, to the back part of the cutter bar of a mowing machine, an adjustable and jointed lever, either with or without a wheel."

170. For an *Improved Arrangement of Means for Operating the Valves of Steam Engines;* Charles K. Landis, Philadelphia, Pennsylvania.

Claim.—"The combined mechanism of the float, slide valve, and double valve."

171. For an *Improvement in Safety Valves for Steam Engines;* Alexander B. Latta, Cincinnati, Ohio.

Claim.—"The mechanical means, or any equivalent arrangement."

172. For an *Improvement in Cotton Gins;* Wm. B. Lindsay, New Orleans, La.

Claim.—"The combination of the reciprocating cards, vibrating stripping cards, and ribs."

173. For an *Improved Excavator;* Charles A. Mann, Jr., Pike, New York.

Claim.—"The construction and arrangement of the cylindrical chambers, formed with the inscribed semi-rotating arms, the scoops, the fingers, and friction disks, with the combination therewith of the springs; the whole operated through the obliquely arranged wheels, in combination with the bowed cam plates. Also, the arrangement of said devices, in combination with the adjustable or graduating framing, and the plough attachment."

174. For an *Improvement in Instantaneous Governors for Steam Engines;* Wm. W. H. Mead, Chestertown, New York.

Claim.—"Combining the fly governor with the throttle valve, by fitting it loosely to the spindle, and driving it by friction from the wheel, which is loose on the same spindle, and which derives its motion from the said spindle through a spring, the said wheel being connected in any convenient manner with the throttle valve or cut-off, so that it may be caused by the retarding or advancing effect of the moment of inertia of the governor or fly, as the speed of the engine is suddenly increased or diminished, as to diminish or increase the supply of steam to the engine."

175. For an *Improved Tool for Boring Hubs;* H. L. Mooney and W. B. Carter, Astoria, Illinois.

Claim.—"The construction of the tool, with the excavating and shouldering cutters, in separate slide bars, capable of a simultaneous outward movement, and relatively so situated, that the shouldering cutter is made to perform the double function of cutting the shoulder, and holding the tool firmly upon the hub."

176. For an *Improvement in Winding Thread from Skeins;* Marcus Ormsbee, Roxbury, Massachusetts.

Claim.—"The arrangement of the hooks, the spools, and the elastic strap."

177. For an *Improved Billiard Que;* Conrad Leicht, City of New York.

Claim.—"The mode of providing said cue top, with screws, and adjusting them to the cues."

178. For *Musical Notation;* Philetus Phillips, Middletown Point, New Jersey.

Claim.—"The use of a line of a distinct character, on which to write each elementary note, and the transposing of such lines, to effect and denote the different transpositions of the scale."

179. For an *Improvement in Looms;* Robert Pilson and Stephen P. Heath, Laurel, Massachusetts.

Claim.—"The combination of a balance catch in the shuttle, in combination with the balance weight in the lathe, acting from gravity."

180. For an *Improvement in Apparatus for Cleaning Gutta-percha;* James Reynolds, City of New York.

Claim.—"The extraction of the bark and foreign substances from gutta-percha, by cutting the blocks of the raw material into extremely thin slices or sheets, and submitting the said slices or sheets to a beating or rubbing and screening operation."

181. For an *Improvement in Hand Propellers;* John G. Ross, City of New York.

Claim.—"The plate and lance points, in connexion with the propelling bucket."

182. For an *Improvement in Self-sealing Preserve Vessels;* William J. Stevenson, City of New York.

Claim.—"In combination with the mouth of the vessel, constructed with a shoulder, at some distance from its entrance, and the packing ring resting on the said shoulder, I claim the cap, made with its bearing part smaller than the exterior of the ring, and with raised guide pieces, which keep it in place in the mouth, so as to cause it to set an equal width of bearing all round the ring, but do not prevent the necessary imbedding of the edge of the bearing part of the cap in the packing."

183. For an *Improvement in Rotary Knitting Machines;* Clark Tompkins and John Johnson, Troy, New York.

Claim.—"The combination of the tension roller with the take-up mechanism, or its equivalent, when applied to rotary knitting machines."

184. For an *Improvement in Making Steel;* Franz Uchatius, Vienna, Austria; patented in Austria, March 14, 1855.

Claim.—" The conversion of pig iron into steel, by subjecting the same, when reduced to a granulated state, to the combined action of oxidizing agents, and the requisite fluxes, whereby I am enabled to manufacture cast steel, of determinate quality, and obtain it at one melting."

185. For an *Improved Shingle Machine;* Henry White, Oneida Castle, N. Y.

Claim.—" The plates, so arranged as to bring the butt of the shingle into the centre between the knives, and hold it there while it is being shaved. Also, the spring forceps, so arranged as to seize and remove the shingle after it is shaved."

186. For an *Improved Valve Gear for Steam Engines;* Herman Winter, City of N. Y.

Claim.—" 1st, An eccentric on the main shaft, a lever properly governed and connected therewith, and a crank upon a secondary shaft—the whole in combination and connected each to each. 2d, An eccentric, or its equivalent, upon a revolving shaft, in combination with a rod or lever connected therewith, receiving a reciprocating motion from the eccentric, and a vibrating motion, whereby valves of steam engines may be raised and lowered. 3d, Forcing rods or levers, caused to reciprocate, to vibrate in the plane of their reciprocation, by a positive motion derived from some convenient part of the engine, through the intervention of bell cranks, radius bars, and links, or their equivalents. 4th, Changing the centre of vibration of reciprocating vibrating levers, or altering the distance through which they vibrate, in combination with a toe or foot, curved, whereby the period of cut-off may be varied. And, lastly, altering the position of the pivots of a bell crank, provided with a link and radius bar, whereby the period of cut-off may be varied at the pleasure of the attendant."

187. For an *Improved Method of Securing Plane Bits;* Thomas D. Worrall, Boston, Massachusetts.

Claim.—" The arrangement of the clamp and the screw rod, with respect to the plane cutter and its stock."

188. For an *Improvement in Grain and Grass Harvesters;* James T. Youart, Troy, New York.

Claim.—" The cutting device, formed of the reciprocating frame, with the straight edged sickle attached, in combination with the square edged collectors, connected with the frame, and having a vibrating movement."

189. For an *Improvement in Replaceable Axle Box for Railroad Cars;* William D. Arnett, Cincinnati, Ohio.

Claim.—" The arrangement by which the entire case can be removed, with the enclosed oil box and bearings; said box or case being slid into place, and attached to the piece upon which the spring rests, by means of the lugs and recess."

190. For an *Improved Method of Drawing Fluids from Bottles;* J. Willard Fox, Durhamville, New York.

Claim.—" Packing the plugs of faucets, with india rubber, gutta-percha, leather, or some other similar substances, when the same piece which packs the plug is made to pack the end of the bottle nose, pipe, tube, or other article to which the faucet is applied."

191. For an *Improvement in Ships' Capstans;* Samuel Gaty, St. Louis, Missouri.

Claim.—" The arrangement of the ratchets and pawls, and spur wheels and pinions, in capstans or windlasses, so that simply reversing the prime mover, will change it from a simple to a compound capstan, without shifting any of the parts by hand, and so that also the spur wheels and pinions may only rotate when used as a compound capstan, and be self-ungearing when changed to a simple one."

192. For an *Improvement in Calipers for Measuring Irregular Forms;* Elliot T. Miller, Charlestown, Massachusetts.

Claim.—" The calipers, consisting essentially of the fingers, plates, and elastic blocks."

193. For an *Improved Coupling for Vehicles;* Henry Miner and Henry M. Stevens, City of New York, and Wm. H. Saunders, Hastings, N. Y.

Claim.—" A ring of vulcanized rubber, or some other yielding and more or less elastic material, applied in combination with a divided eye, and a bolt or pin in the clips, either immovably or in such manner that it can be taken out and replaced—the whole being applied to vehicles."

194. For an *Improvement in Ships' Capstans;* Daniel and George Tallcot, Oswego, New York.

Claim.—"The gears arranged at the top of the capstan, in combination with the shaft, and gears arranged at the bottom of the capstan, for communicating a slow and powerful motion to the barrel."

195. For an *Improved Machine for Manufacturing Felloes;* A. B. Richmond, Meadville, Pennsylvania.

Claim.—"1st, The saws, constructed so that they may be adjusted at any required circle, by means of the set screws, and also constructad with the saw hands and fingers, and slots and set screws combined. 2d, The contrivance and construction of platform, with the combination of gauges and set screws, for cutting the felloe the proper length. 3d, The combination by which the bits for the spokes and dowel pins are made to move towards the felloe, at the same time, or different times, as may be desired."

196. For an *Improvement in Self-acting Mules;* Wm. W. Weir, Chicopee, and Wm. Grover, Holyoke, Massachusetts.

Claim.—"The application to mules, of the faller, denominated a third faller, operated by the mechanism or the equivalent thereof, when used in combination with a faller, and counter faller. Also, the combination and arrangement of the levers and latch."

197. For an *Improvement in Ploughs;* George W. Zeigler, Tiffin City, Ohio.

Claim.—"Simply an improvement upon the invention of Norton; that is to say, combining with land side and mould board, a cutter, jointed to the land side, and movable between land side and mould board, independent of the mould board and share."

198. For an *Improvement in Corn Shellers;* Charles S. C. Crane, Assignor to Samuel M. Tinkham, Taunton, Mass.

Claim.—"The shelling wheel, toothed or corrugated on both sides, the pressure bars, provided with plates on their upper ends, and the feeding device, composed of the uprights and the board."

199. For an *Improvement in Valves in Steam Engines;* John F. Allen, City of New York, Assignor to Noah L. Cole, Norwich, Conn.

Claim.—"The movable valve seat, arranged and operating between the valve and the usual valve seat."

200. For an *Improvement in Parlor Organs;* Thomas Sands, Chelsea, Assignor to self, and John P. Lindsay, Roxbury, Massachusetts.

Claim.—"Arranging the pipes horizontally in compact tiers, one above the other, when each succeeding tier is placed at a greater distance from the wind chest than the one below it, for the accommodation of the mouths of the pipes—all the pipes, except those of the lower tier, being connected with the wind chest, by means of the conductors. 2d, The peculiar combination and arrangement of the action with the short keys; that is to say, the combination of the keys, the levers, the stickers, and the jacks. 3d, The coupler rods, with their bent wires, in combination with the stickers, and the auxiliary stickers, for the purpose of coupling the notes with their actions. 4th, The method of holding the metallic pipes in place, by means of the bar, the rod, and the spring."

ADDITIONAL IMPROVEMENTS.

1. For an *Improved Faucet;* Moses Woodbury, Boston, Mass.; patented March 11, 1856; additional May 6, 1856.

Claim.—"The combination of the screw, or its mechanical equivalent, with a hollow cylinder-valve, and the spring, when the latter is placed behind the valve."

2. For an *Improvement in Means for Holding Window Blinds;* Henry A. Frost, Worcester, Mass.; patented January 23, 1855; additional May 6, 1856.

Claim.—"The improved manner of hanging the brace, so that it will operate freely, by its own weight, and casting or swedging the notches, or their equivalent, so as to retain the blind in any desirable position."

3. For an *Improved Coupling for Carriages;* Abram J. Gibson, Clinton, Massachusetts; patented Sept. 12, 1854: additional May, 27, 1856.

Claim.—"Arranging above the threaded bolt, and with respect to the guard from which it extends, a seat or connexion, for the spring or other part of a carriage. Also, arranging in the threaded bolt, and so as to pass up through it and its rest, a socket or passage for the reception of a screw bolt, serving not only to confine a spring or bar down upon the seat, but for the specific purpose of preventing accident, in case of breakage of the threaded bolt at its neck."

RE-ISSUES FOR MAY, 1856.

1. For a *Preparation of Oil Ground to receive Photographic Impressions;* Joel H. Tatum, Baltimore, Maryland; patented April 15, 1856; re-issued May 13, 1856.

Claim.—"The mode of preparing and rendering oil (or oleaginous) bodies, grounds, or surfaces, impressible or sensitive to the photographic art, by the temporary destruction or chemical change of the oil, or oleaginous matter, on the immediate surface only, by the use of spirits of wine and alkaline solution, or their equivalents, and after fixing the impression, by the use of hypo-sulphate of soda, the use of dilute acid, by which last application, the alkalies are neutralized, and the oil restored, with the impression permanent upon the surface."

2. For an *Improvement in Machines for Planking Hat Bodies;* Albert Spencer and Alve E. Laing, Assignees of Phineas Emmons, City of New York; patented April 19, 1853; re-issued May 27, 1856.

Claim.—"The use of an endless table, or band, having a differential or vibratory forward revolving motion, in combination with a rubber or presser, whereby a forward, vibratory, rolling, and pressing motion is given to the *roll* of hat bodies, or felt, for sizing it up, and at the same time, carrying it through the machine."

DESIGNS FOR MAY, 1856.

1. For *Piano-Forte Legs;* Isaac Engel, Boston, Mass.; May 13, 1856.

Claim.—"The ornamental design."

2. For *Cooking Stoves;* Anthony J. Gallagher, Philadelphia, Pennsylvania.

Claim.—"The arrangement and combination of the ornaments."

3. For *Parlor Stoves;* N. S. Vedder and Wm. L. Sanderson, Assignors to N. S. Vedder, Troy, New York; May 13, 1856.

Claim.—"The ornamental design and configuration."

4. For *Plates of Cooking Stoves;* W. L. Sanderson and N. S. Vedder, Assignors to Sanders, Wolfe & Warren, Troy, New York; May 13, 1856.

Claim.—"The ornamental design and configuration."

5. For *Oven and Stove Doors;* Joseph A. Reed, Assignor to John H. Cahill, Philadelphia, Pennsylvania; May 13, 1856.

Claim.—"The figures."

6. For *Stoves;* Samuel W. Gibbs, Assignor to W. and J. Treadwell, Perry, & Norton, Albany, New York; May 20, 1856.

Claim.—"The combination and arrangement of ornamental figures, &c."

7. For *Parlor Stoves;* David Hathaway, Assignor to Cox, Richardson, & Boynton, Troy, New York; May 20, 1856.

Claim.—"The ornamental configuration of plates."

8. For *Cooking Stoves;* Thomas A. Herrick, East Bridgewater, Assignor to Samuel M. Leonard, Taunton, Massachusetts; May 20, 1856.

Claim.—"The ornamental design of the doors and side plate."

9. For *Combined Match Safes, Paper Weights, and Pin Cushions;* Michael B. Dyott, Philadelphia, Pennsylvania; May 27, 1856.

Claim.—"The new design."

10. For *Portable Ranges;* James Horton and John Currie, Assignors to Cox, Hager & Cox, Philadelphia, Pennsylvania.

Claim.—"The designs, &c., of the ornaments in bas-relief, and mouldings."

11. For *Piano-Forte Legs;* Albert Bosworth, Assignor to self, and Timothy H. Loomis, Westfield, Massachusetts; May 27, 1856.

Claim.—"The form, &c., of the central fluted column, and the pendant or jutting device."

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

Description of D. R. Perkinpine's Patent Axle Box, for Locomotives and Railway Cars. By H. Howson, Civ. Eng.

This invention, for which a patent has been recently granted, and which has been already alluded to in this Journal, [page 359, Vol. xxi,] consists in constructing and arranging the axle boxes of locomotives and cars, in such a manner, that the outside end and bottom, (which is cast in one piece separate from the other portions of the box,) may be easily removed and replaced at pleasure, and with it a reservoir for the oil and cotton, which reservoir is likewise a separate and distinct casting; the object being in order that the axle bearing and journal may be easily examined, and the reservoir cleansed and replenished with lubricating matter, with greater ease and facility than the same can be accomplished in other axle boxes.

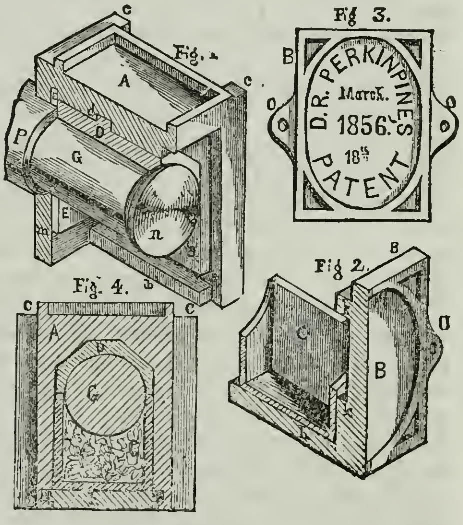


Fig. 1, is a sectional perspective view of half the box.

Fig. 2, a perspective view of half the movable front and bottom, showing the oil reservoir.

Fig. 3, an end view of the box.

And Fig. 4, a transverse section of the same.

A, is the shell of the box, having flanches *c c*, which act as retaining pieces, when placed in the hanger of the locomotive or car, in the same manner as ordinary boxes.

On the inside are cast pieces *a a*, shaped at the top in such a manner as to receive the brass step D, which is maintained in its proper position by the projection *d*, fitting into a recess formed in the box.

A groove *e*, divides the piece *a*, from the flanch *b*, and into this groove slides the bottom *h*, of the movable piece B, projections *f*, being arranged on the latter for this purpose.

C, is the reservoir, in which is placed the cotton saturated with oil, or other lubricating matter; this reservoir is arranged at the top to fit pretty accurately to the journal of the axle, and rests on the bottom *h*, of the movable piece B; in front of the latter are two lugs *o o*, through which pass small set screws, serving to confine the movable piece to the body of the box.

On the outside of the piece B, is a recess *k*, of a circular form, to receive the collar *n*, of the axle G. E is a piece of leather, fitting accurately to the enlarged portion *p*, of the axle, and confined between the step D, and back *m*, of the axle box A, in a recess formed for the purpose, thus preventing any escape of the oil in that direction. It will be easily seen without further description, that by simply withdrawing the small set screws, which pass through the lugs *o o*, into the body of the box, the piece B, with the reservoir C, can be readily removed and replaced, affording every facility for examining the journal, and for cleansing and replenishing the reservoir.

For the Journal of the Franklin Institute.

The Steam Frigate Niagara.

The readers of the *Journal* are, no doubt, aware that this steamer is building under the exclusive direction of Mr. Steers, noted as the builder of the yacht *America*, who has been employed by the Secretary of the Navy for that purpose. Mr. Steers has had his own way, and if he fails in any particular, the fault will be his own. Having recently visited the vessel, I will give you my impressions in relation to her; which, I am sorry to say, are not as favorable as I could wish. She has been designed for great speed, having one-half more power than the other vessels now building, and in taking care of that point, many others of equal or greater value have been overlooked. I have no doubt she will be fast; in fact, I am quite sure of it; but her coal bunker capacity will only be about 12 days' full steaming, if so much. Her capacity for stores is so much below what it should be, that her water tanks are being constructed to fit down to the bilge, filling the space between the kelsons (which it is all essential should be left open and arranged for easy cleaning in warm climates). When the ship was commenced, 100 feet was given up to engines, boilers, and coal bunks, but since her internal capacity has been found so small, seven feet of this space has been taken off, which has reduced the coal capacity to a very low point for her power. On the berth deck the officers' quarters are very roomy, and occupy a large portion of it. While the forward part, devoted to the crew, will (considering the number that occupy it) be found very small. Her gun deck, which is also the spar deck, will no doubt have sufficient room for her small armament of 12 guns. Compared with the other five war steamers, she will have the advantage of speed only, and this is of no advantage in an engagement, (unless it be to run away;) they carry 40 guns, and at each broadside will discharge more than double the weight of shot or shells; they have two tiers of guns, and every shot would be effective in close action, while her guns all being on her upper deck, high above the water, would often fire too high, particularly in close action with a low vessel. To the eye, externally, the *Niagara* is very large, but internally, she is found very small for her tonnage. This deception is owing to her high rail, which deceives the eye looking from without, and having but two decks, while the other vessels have three. Her draft of water will be greater than theirs, so that she can only enter a few of the harbors in the world It has been quite the fashion for some years past to decry our naval steamers, (which are really unsurpassed by any naval steamers of the same tonnage afloat,) and the editor of one of our Nautical Magazines, has, in his zeal for improvement, often asserted that it was easier to make a war steamer correct in every respect than a private vessel, because in the former, the load was known, while in the latter, it is constantly changing. If he had asserted that to a constructor *knowing* what were the requirements of a war steamer, it would be easier, the remark would have been a true one, but I hold that the building of war vessels is as much a profession as the building of merchant ships, and, although I have a very high respect for our private ship builders who have raised the character of our merchant marine to a point far above that of any other nation, yet I doubt if any of them are fully acquainted with all the requirements of a man-of-war. I am certain that the constructor of the *Niagara* finds many things overlooked, and hence the difficulty of finding room for all she has to carry. I do not wish to be understood as condemning the *Niagara* or fully approving the other ships; both can, no doubt, be improved, and a proper medium between them be found, where capacity will not be sacrificed to speed, and where the number of guns shall exceed three to each 1000 tons measurement. The other five steamers building, are, no doubt, indebted somewhat for their form to the desire of using up the timber frames long on hand at our Navy Yards. With a fresh lot of timber to work from, six inches more head room on the berth deck, and side lights a little less antique, I believe our naval constructors would produce vessels creditable to the navy, if not up to the Young America standard of every thing for speed and nothing for capacity. FULTON.

For the Journal of the Franklin Institute.

Mechanical Engineering as applied to Farm Implements.

By H. HOWSON, Civ. Eng.

(Continued from page 406. Vol. XXXI, 3d Series.)

It is curious to observe on looking over the past and present records of the Patent Office, how the attention of the ingenious portion of the community, has been directed at one time to one particular class of subjects; thus, at one period there existed a perfect mania among inventors, in relation to churns, at another period the competition in washing-machines was most intense; then came the era of harvesters, seed planters, sewing-machines, corn and cob mills, &c., &c.

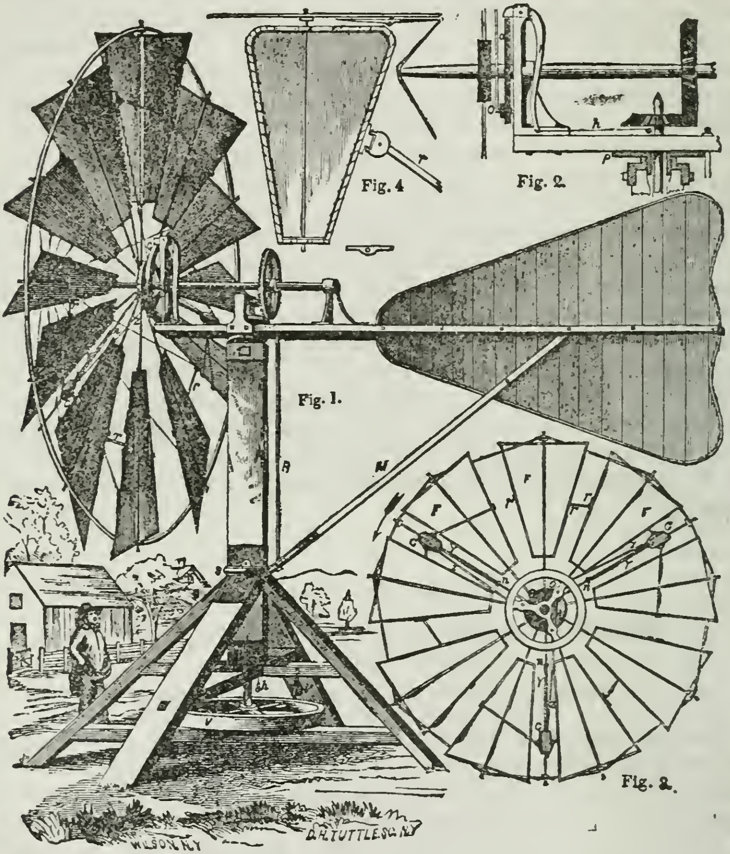
The improvements in wind-mills are now so numerous and varied, and succeed each other so fast, that the present may not inaptly be termed the wind-mill era.

It will not therefore be out of place to record, from time to time, in these papers, some of the many improvements in this class of machinery, improvements which must eventually result in rendering wind-mills a most popular means of obtaining motive power, especially among farmers.

The annexed engraving represents the patent "Self-regulating Wind-mill," of F. G. Johnson, a gentleman who has paid much attention to the subject, and who is the author of an interesting treatise entitled "Wind as a Motive Power."

Fig. 1 is a perspective view, and Figs. 2, 3 and 4 detached sectional views, of Mr. Johnson's improvements.

The main upright beam or stem of the machine is hollow, and rests on and is secured to the cross-pieces, which connect the diagonal stays together, the latter being firmly planted into the ground. To the top of the stem is secured the socket, in which turns the plate P, the latter being attached to the underside of the swivel beam, on which are secured two brackets which act as bearings for the horizontal shaft, to which is secured a bevel wheel, gearing into a similar wheel on the vertical shaft, which has its upper bearing in the plate, and passing down the interior of the stem, has its lower bearing in the cross-piece which is secured to the diagonal stays, between the latter and the other cross-pieces; it is furnished with a horizontal driving pulley.



The guiding vane, which is secured to the swivel beam, is braced by the rod M, the latter being connected to the ring which turns on the stem near the top of the diagonal stays; this brace, in connexion with the tie rod R, brings the strain of the mill in its tendency to be blown over on the bottom of the stem, as well as the top; F, F, &c., are the vanes secured to the spindles, which have their bearings at one end in the external ring, and at the other end, and in the hub B, attached to the shafts G, G, are weights arranged to slide on rods *g g*, which extend from the external ring E, to the central hub ; on these rods are regulating nuts *n*, between which and the weights, intervene spiral springs Y. The sliding weights G, are connected by means of rods *r*, to the edges of the vanes, one weight to three vanes. The weights are also connected by means of rods *z*, to pins in the arms of the stop-wheel *c*, which run loose on the shaft. On the top of the front bracket a bent lever I, has its fulcrum; this lever is so arranged, that when required, its point may be made to bear on the periphery of the stop wheel *c*. A cord *h*, is attached to the end of the long arm of the lever, and passes over a pulley and down the stem, at the lower end of which, it is furnished with a weight.

The sliding weights G, figs. 1 and 3, connecting rods *r*, and spiral springs Y, constitute the governor, or regulating apparatus. When the wheel revolves at its maximum velocity, the weights by centrifugal force are thrown out from the centre, and the extremities of the rods *r*, drawn closer together, which causes the vanes to turn edgewise to the wind. The tendency of the vanes is now to revolve slower and slower, until the tension of the springs shall overcome the centrifugal force of the weights, which will slip or draw them in towards the centre again, and thus turn the vanes flat to receive the wind, and give the mill (whenever the wind is sufficiently strong), a uniform velocity, irrespective of the variation of wind, and resistance presented to it. One weight controls three wings by connecting one to another. To give the mill greater or less velocity, it is only necessary to increase or diminish the tension of the springs Y, which is accomplished by turning the nuts *n*, out from, or in towards the centre. To provide against very strong and sudden gusts of wind, the vanes are made wider on the back than on the front side of their bearings, so that they will turn back and crowd the weights out from the centre, before the velocity necessary to do the same could be acquired.

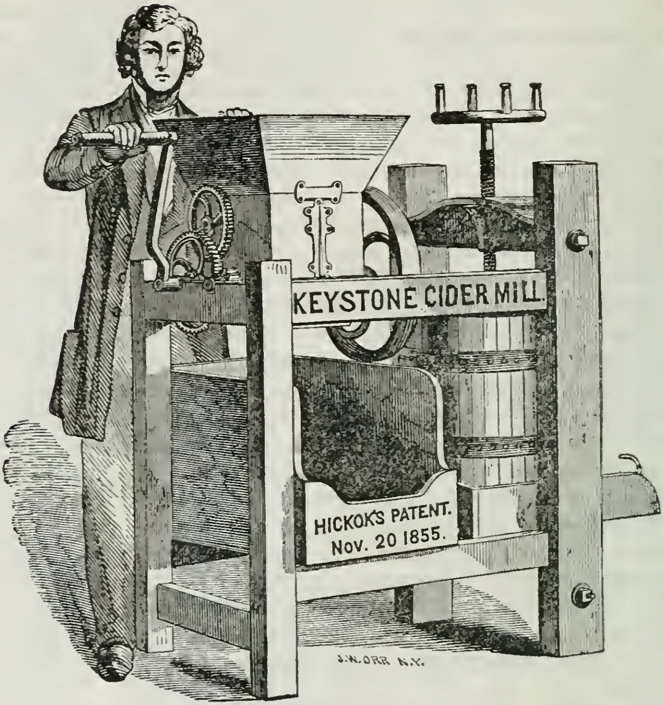
The stop wheel *c*, and the rods *z*, connecting it, and the weights constitute the stopping apparatus, which operates as follows: Thus, supposing brake levers I, (fig. 2,) to be pressing upon the stop wheel, and thus stopping, or rather holding back said wheel, while the main wheel turns on ; then the point O would rise to *o*, or so far above the shaft A, as now it is below it, and thus throw out the weights from G to *g*, and turn all the wings edgewise to the wind, causing them to stand still until the brake is released; the brake is made to operate by means of a weight hung upon a cord *h*. This governor and stopping apparatus it will be seen, revolve with, and constitute a part of the wind-wheel, and are independent of any other part of the mill, thus making the wind-wheel alone self-regulating, and almost self-stopping in spite of any gale.

These mills are sold at prices ranging from $60 to $800, according to size. For the lowest sum a machine is furnished having the power, during a pleasant breeze, of about one man.

Hickok's Patent Cider Mill.

This neat and compact mill will be easily understood from the annexed engravings, without a minute reference to the various parts.

Two operations, the grinding and pressing, are performed on the same frame.

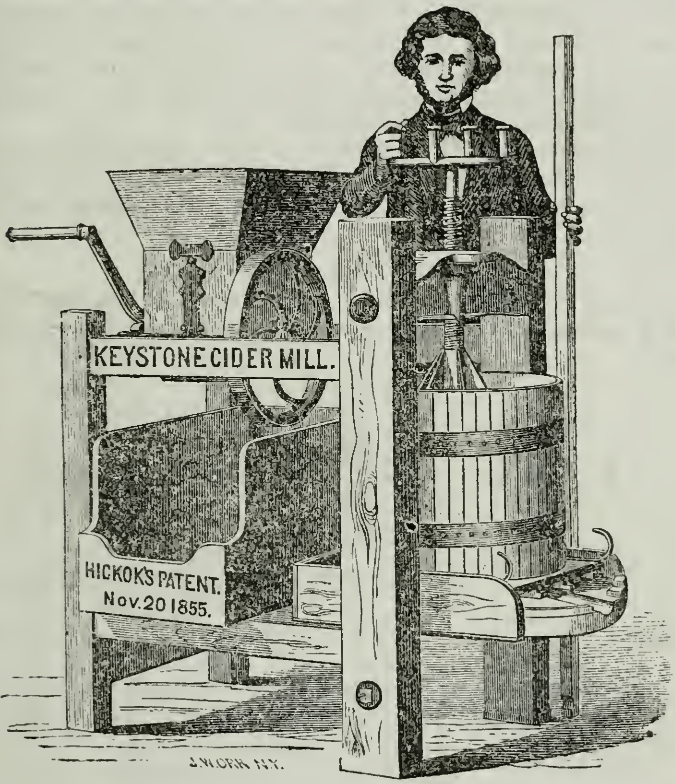

KEYSTONE CIDER MILL.
HICKOK'S PATENT.
Nov. 20 1855.
J.W.ORR N.Y.

On one end of the latter is secured a hopper, hinged to a box, in the upper part of which is a roller having projections which serve to crush the apples, preparatory to their being acted upon by the two grinding rollers, which consist of iron cylinders, having a number of longitudinal ribs, and crossing these ribs a series of helical strips; in the spaces formed between the ribs and the strips, are projecting teeth. A patent was granted to Mr. Hickok, in November last, for this ingenious arrangement of grinding cylinders, which are so connected by toothed wheels, that one always revolves faster than the other, causing the apples to be rapidly reduced to pomace, which drops into a reservoir below. The shaft of one of the grinding rollers is furnished at one end with a balance wheel, and at the opposite end with a winch, by which the gearing and rollers are set in motion.

On the other end of the frame is secured the pressing apparatus, which consists of a strong screw, arranged to turn in a bracket, secured to two of the uprights of the frame.

The end of this screw is furnished with a disk or piston, fitting the interior of the barrel, which is formed of parallel staves, firmly secured together by means of suitable iron hoops, there being a narrow opening between each stave.

By an arrangement of sieves at the bottom of the barrel, the old fashioned bag is dispensed with, while at the same time the cider is left clear, and the work can be accomplished with much less labor than by the old method.


KEYSTONE CIDER MILL.
HICKOK'S PATENT. Nov. 20 1855.

The above machine is simple, strong, and durable in its construction, efficacious in its results, and moderate in its price, which is but $40; qualities which have rendered it deservedly popular, vast quantities being manufactured at the inventor's establishment in Harrisburg.

Messrs. Landreth, the extensive manufacturers of, and dealers in, agricultural implements, are the agents in this city.

(To be Continued.)

*On the Commercial Economy of Working Steam Expansively in Marine Engines.** By Mr. EDWARD E. ALLEN, of London.

(Continued from page 401. Vol. xxxi.)

In order to give a more complete view of the difference between the economy resulting from the increased expansion of ordinary steam, and that arising from the increase of pressure of the steam itself, the two following series of Tables, Nos. XXII., and XXIII., have been compiled.

The first series, XXII., is based on the supposition that the size of the engines is increased to 1½, 2, 2½, and 3 times for expansive working; but that from improved machinery and reduction in the weight of boilers (from diminished consumption of fuel), the gross weight of machinery and the space occupied remain constant.

The second series, XXIII., is based on the supposition that the size of the engines remains constant, as well as the gross weight of machinery, and the space occupied; but that the pressure increases from 35 lbs. to 60, 80, 100, and 120 lbs.

TABLE XXII.—SECTION A.

Table showing the weights of machinery and coal, and joint weights of same; the size or nominal H. P. *increasing from* 1 *to* 3, *the indicated* H. P. *remaining the same.*

Class.	Service.	Ratio of size or nominal H. P.	Gross weight of machinery constant*	Ratio of weight of coal corresponding to increased nominal H. P.	Ratio of total weights.	Ratio of time the coal would last, if total weights be kept the same.	Ratio in days.
1	River.	1	1	·25	1·25	1·00	2½
		1½	1	·20	1·20	1·23	3
		2	1	·18	1·18	1·40	3½
		2½	1	·16	1·16	1·58	4
		3	1	·14	1·14	1·75	4¼
2	Coasting and Continental.	1	1	1·00	2·00	1·00	10
		1½	1	·81	1·81	1·23	12¼
		2	1	·71	1·71	1·40	14
		2½	1	·63	1·63	1·58	15¾
		3	1	·57	1·57	1·75	17½
3	Ocean (short voyages) and Government.	1	1	1·50	2·50	1·00	15
		1½	1	1 21	2·21	1·23	18½
		2	1	1 06	2·06	1·40	21
		2½	1	·94	1·94	1·58	23¾
		3	1	·85	1·85	1·75	26¼
4	Ocean (long voyages), Australian.	1	1	4·00	5·00	1·00	40
		1½	1	3·24	4·24	1·23	49¼
		2	1	2·84	3·84	1·40	56
		2½	1	2·52	3·52	1·58	63¼
		3	1	2·28	3·28	1·75	70
5	Ocean (voyage out and home), Eastern Steam Navigation Company.	1	1	7·00	8·00	1·00	70
		1½	1	5·67	6·67	1 23	86
		2	1	4 97	5·97	1·40	98
		2½	1	4·41	5·41	1·58	110½
		3	1	3·99	4·99	1·75	122½

* Weight of boilers and water supposed to be reduced, and weight of engines not increased in higher ratio.

* From the London Artizan, Feb. and April, 1856.

In both series of Tables, XXII. and XXIII.,

Sections A refer to the total weights.
Sections B " " spaces.
Sections C " " cargo-space.
Sections D give a summary of the preceding sections.

Table XXII.—Section B.

Tables showing the spaces occupied by engines, boilers, and passages together, and by coals; and also the ratio of the total spaces; the size or nominal H. P. *increasing from* 1 *to* 3, *the indicated* H. P. *remaining the same.*

Class.	Service.	Ratio of size or nominal H. P.	Space occupied by engines, boilers, and passages constant. *	Ratio of spaces occupied by coals.	Ratio of total spaces.
1	River.	1	3	1·00	4·00
		1½	3	·81	3·81
		2	3	·71	3·71
		2½	3	·63	3·63
		3	3	·57	3·57
2 and 3	Coasting and Continental, and Ocean (short voyages).	1	3	3·00	6·00
		1½	3	2·43	5·43
		2	3	2·13	5·13
		2½	3	1·89	4·89
		3	3	1·71	4·71
4 and 5	Ocean (long voyages), and voyage out and home.	1	3	5·00	8 00
		1½	3	4·05	7·05
		2	3	3·55	6·55
		2½	3	3·15	6·15
		3	3	2·85	5·85

* Space occupied by boilers and passages, supposed to be reduced, and space occupied by engines not increased in higher ratio.

Tables XXII. show the results of increased expansion of ordinary steam.

Sections A and B show how the total weights of machinery and coals taken together, and also the total spaces occupied by them, decrease from Classes 1 to 5, on the supposition that the gross weight of machinery and the space occupied by it remain constant.

Section C shows how the cargo-space continually increases from Class 1 to 5.

Section D gives a general summary of the three preceding ones, and shows the per centage of increase of time the coals would last, if the total weights of machinery and coals taken together, were the same; and as this depends upon the saving in coal alone, the weight of machinery being supposed constant, it amounts to the same in all the classes; being equal to 40 per cent. if the engines be doubled in size, and 75 per cent. if the engines be increased to three times the size.

The two last columns in Table XXII., Section D, give the annual per centage gain on the capital, from saving in coal and gain in cargo-space; first, when the net profits cover the cost of vessel in one year; and, second, when the net profits cover the cost of vessel in two years; the total machinery and coal space being taken at two-thirds of the total cargo-space in each case.

TABLE XXII.—SECTION C.

Table showing the gain in CARGO SPACE, *when the space occupied by the engines, boilers, and passages is constant;* the size or nominal* H. P., *increasing from* 1 *to* 3 *the indicated* H. P. *remaining the same.*

Class.	Service.	Ratio of size or nominal H. P.	Ratio of total spaces occupied by machinery and coals, from foregoing table.	The same ratio, but showing the per centage decrease.	Per centage gain in cargo-space.		
					1st. When total machinery and coal space is *equal* to total cargo-space.	2d. When total machinery and coal space is ⅔ of total cargo-space.	3d. When total machinery and coal space is ½ of total cargo-space.
					Per cent.	Per Cent.	Per Cent.
1	River.	1	4·00	100	—	—	—
		1½	3·81	95	5	3½	2⅛
		2	3·71	93	7	4⅔	3⅛
		2½	3·63	91	9	6	4½
		3	3·57	89	11	7⅛	5½
2 and 3	Coasting and Continental, and Ocean (short voyages.)	1	6·00	100	—	—	—
		1½	5·43	90	10	6⅔	5
		2	5·13	85	15	10	7½
		2½	4·89	81	19	12⅔	9½
		3	4·71	78	22	14⅔	11
4 and 5	Ocean (long voyages,) and voyage out and home.	1	8·00	100	—	—	—
		1½	7·05	88	12	8	6
		2	6·55	82	18	12	9
		2½	6·15	77	23	15⅓	12½
		3	5·85	73	27	18	13½

---

* Space occupied by boilers and passages supposed to be reduced, and space occupied by engines not increased in higher ratio.

It is only on the supposition that the net profits for a given period cover the cost of vessel or capital, that the gain from increase of cargo-space can be added to the gain from saving in coal. If the vessel be supposed to have cost a sum equal to the net profits of three or any number of years, then, in order to find the total annual gain, it is only necessary to divide the annual per centage gain from the increase of cargo-space by 3, or any number determined on, and add the quotient to the annual per centage gain from saving in coal; the sum will be the gross annual per centage gain on capital.

Tables XXIII. show the results of increase of pressure of the steam itself.

The use of Section A may be thus illustrated; taking the 2d class of steamers, it is seen that if steam of 35 lbs. pressure be used and cut off at ¾ths, a weight of coal equal to the weight of machinery will last ten days; but if steam of 80 lbs. pressure be used (in the same sized cylinder), then the same power will be developed by a consumption of 43 per cent. of the fuel, the steam being cut off at $\frac{3}{20}$ths; and a weight of coal equal to the weight of machinery would last 23 days instead of 10. In like manner, if steam of 120 lbs. pressure be used (also in the same sized cylinder), then the same power will be developed by a consumption of 35 per cent. of the fuel, the steam being cut off at about $\frac{1}{12}$th; and a weight of coal equal to the weight of machinery would last 28 days instead of 10. In all the other classes of steamers the same proportions hold good.

Table XXII.—Section D. General Summary.

Table compiled from the three foregoing Tables; the cost, weight, and space of engines, boilers, and passages, and water, being constant; the size or nominal H. P. *increasing from* 1 *to* 2 *and* 3 *times (the intermediate sizes being omitted), the indicated* H. P. *remaining the same.*

Class.	Service.	Ratio of size or nominal H. P.	Annual saving of coal in per centage of capital (Table XVIII).	Increase of capital per cent.	Total weight of coal and machinery; decrease per cent. (deduced from column 6, section A).	Total spaces occupied by coal and machinery; decrease per cent. (deduced from column 6, section B).	Cargo space: increase per cent.			Per centage of increase of time the coals would last, if total weights be kept the same.	Number of days the coals would last, if total weights be kept the same.	Annual per centage gain of capital from saving of coal and increase of cargo-space.	
							1st. When total machinery and coal space is *equal* to total cargo-space.	d. When total machinery and coal space is *2-3rds* of total cargo-space.	3d. When total machinery and coal space is *half* of total cargo-space.			If the net profits cover cost of vessel in one year.	If the net profits cover cost of vessel in two years.
			Per Cent.		Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		Per Cent.	Per Cent.
	River.	1	...	Capital constant; cost of boilers supposed to be reduced, and cost of engines not increased in higher ratio.	....	....	....	....	....	....	2½	....	....
1		2	4·35		5·60	7	7	4⅔	3½	40	3½	9·01	6·68
		3	6·45		8·80	11	11	7⅓	5½	75	4¼	13·78	10·11
	Coasting and Continental.	1	...		....	....	....	....	....	....	10	....	....
2		2	1·45		14·50	15	15	10	7½	40	14	11·45	6·45
		3	2·15		21·50	22	22	14⅔	11	75	17½	16·81	9·48
	Ocean (short voyages) and Government	1	...		....	....	....	....	....	....	15	....	....
3		2	1·45		17·60	15	15	10	9	40	21	11·45	6·45
		3	2·15		26·00	22	22	14⅔	13½	75	26¼	16·81	9·48
	Ocean (long voyages) Australian.	1	...		....	....	....	....	....	....	40	....	....
4		2	7·25		23·20	18	18	12	7½	40	56	19·25	13·25
		3	10·75		34·40	27	27	18	11	75	70	28·75	19·75
	Ocean (voyage out and home).	1	.		....	....	....	....	....	....	70	....	....
5		2	1·45		25·37	18	18	12	9	40	98	13·45	7·45
		3	2·15		37·62	27	27	18	13½	75	122½	20·15	11·15

Sections A and B show how the total weights of machinery and coals taken together, and also the total spaces occupied by them, decrease from Class 1 to 5, owing to a saving of coals alone. No advantage has been taken of the decrease in the space required for the boilers, although much less fuel is used; because high-pressure boilers usually occupy more space, for the same power, than low-pressure boilers.

Section C shows how the cargo-space continually increases from Class 1 to 5.

The last section of Table XXIII. gives a general summary of the three preceding ones.

TABLE XXIII.—SECTION A.

Table showing the WEIGHTS *of machinery and coal, and joint weights of same; the total pressure increasing from* 35 *to* 60, 80, 100, *and* 120 *lbs. per square inch; the size or nominal* H. P. *of the engines, the indicated* H. P., *and the gross weight of machinery remain the same.*

Class.	Service.	Total pressure of steam in lbs. per square inch.	Weight of machinery supposed constant.	Ratio of weight of coal corresponding to increased pressure.	Ratio of total weights.	Ratio of time the coal would last, if total weights be kept the same.	Ratio in days.
1	River.	35	1	·25	1·25	1·00	2½
		60	1	·132	1·132	1·88	4¾
		80	1	·109	1·109	2·32	5¾
		100	1	·095	1·095	2·63	6½
		120	1	·087	1·087	2·85	7
2	Coasting and Continental.	35	1	1·00	2·00	1·00	10
		60	1	·53	1·53	1·88	19
		80	1	·43	1·43	2·32	23
		100	1	·38	1·38	2.63	26
		120	1	·35	1·35	2·85	28
3	Ocean (short voyages) and Government.	35	1	1·50	2·50	1·00	15
		60	1	·795	1·795	1·88	28
		80	1	·645	1.645	2·32	35
		100	1	·570	1·570	2·63	39½
		120	1	·525	1·525	2·85	42¾
4	Ocean (long voyages), Australian.	35	1	4·00	5·00	1·00	40
		60	1	2·12	3·12	1·88	75
		80	1	1·72	2·72	2·32	93
		100	1	1·52	2·52	2·63	105
		120	1	1·40	2·40	2·85	114
5	Ocean (voyage out and home), Eastern Steam Navigation Company.	35	1	7·00	8·00	1·00	70
		60	1	3·71	4·71	1·88	132
		80	1	3·01	4·01	2·32	162
		100	1	2·66	3·66	2·63	184
		120	1	2·45	3·45	2·85	200

It will render the results of these tables more easily understood, to trace them out with reference to one of the five classes of steamers, and as one of the most important, Class 4, or the Australian vessels, may be taken. From Table I. it will be seen that the quantity of coal usually taken is equal to about four times the gross weight of machinery, and that this quantity lasts about forty days, that is, with 35 lbs. steam, cut-off at three-fourths of the stroke. From table VIII. it will also be seen that the quantity of coal annually consumed, if the vessels be kept at work, amounts to 25 per cent. of the cost of the vessels or capital.

TABLE XXIII.—SECTION B.

Table showing the SPACES *occupied by engines, boilers, and passages together, and by coals; and also the ratio of the Total Spaces; the total pressure increasing from* 35 *to* 60, 80, 100, *and* 120 *lbs. per square inch; the size or nominal* H. P. *of the engines, the indicated* H. P., *and the total space occupied by machinery remaining the same.*

Class.	Service.	Total pressure of steam in lbs. per square inch.	Space occupied by engines, boilers and passages constant.	Ratio of spaces occupied by coals.	Ratio of total spaces.
1	River.	35	3	1·00	4·00
		60	3	·53	3·53
		80	3	·43	3·43
		100	3	·38	3·38
		120	3	·35	3·35
2 and 3	Coasting and Continental, and ocean (short voyages).	35	3	3·00	6·00
		60	3	1·59	4·59
		80	3	1·29	4·29
		100	3	1·14	4·14
		120	3	1·05	4·05
4 and 5	Ocean (long voyages), and voyage out and home.	35	3	5·00	8.00
		60	3	2·65	5·65
		80	3	2·15	5·15
		100	3	1·90	4 90
		120	3	1·75	4·75

Upon referring to Section D., Table XXII., it appears that if the cylinders be doubled in capacity, to allow of more expansive working, the coal required for the same time and to develop the same power is so far reduced, that 7¼ per cent. per annum is saved on the original capital; and that if the weight of coals carried be kept the same, they will last fifty-six days instead of forty. Also, if the cylinders be increased in capacity to three times, the annual saving in coal will amount to 10¾ per cent. on the original capital; and if the same weight of coals be carried, they will last seventy days instead of forty.

Table XXIII.—Section C.

Table showing the Gain in Cargo Space, *when the space occupied by the engines, boilers, and passages is constant; the total pressure increasing from* 35 *to* 60, 80, 100, *and* 120 *lbs. per square inch; the size or nominal* H. P. *of the engines, and the indicated* H. P. *remaining the same.*

Class.	Service.	Total pressure of steam in lbs. per square inch.	Ratio of total spaces occupied by machinery and coals, from foregoing table.	The same ratio, but showing the per centage decrease.	Per centage gain in cargo-space. 1st. When total machinery and coal-space is *equal* to total cargo-space.	2d. When total machinery and coal-space is 2-3*ds* of total cargo-space.	3d. When total machinery and coal-space is *half* of total cargo-space.
					Per cent.	Per cent.	Per cent.
1	River.	35	4·00	100			
		60	3·53	88	12	8	6
		80	3·43	86	14	9⅓	7
		100	3·38	84	16	10⅔	8
		120	3·35	83	17	11⅓	8½
2 and 3	Coasting and Continental, and Ocean (short voyages).	35	6·00	100	—	—	—
		60	4·59	76	24	16	12
		80	4·29	71	29	19⅓	14½
		100	4·14	69	31	20⅔	15½
		120	4·05	67	33	22	16½
4 and 5	Ocean (long voyages) and voyage out and home.	35	8·00	100	—	—	—
		60	5·65	71	29	19⅓	14½
		80	5·15	64	36	24	18
		100	4·90	61	39	26	19½
		120	4·75	59	41	27⅓	20½

(To be continued.)

For the Journal of the Franklin Institute.

Extracts from the Diary of Charles Schinz, *Consulting Chemist of Camden, New Jersey, during a Journey in Europe.*

Visiting the establishment of a morocco tanner, I saw a very simple thing, which, however, I found extremely practical and economical. These are the many vats wanted to plunge the skins in to impregnate them with different substances. These vats used to be made either of wood or large plates of sandstone; both were costly and required repairs, and the former, especially, lasted only a limited number of years. Now, these vats are made of a more durable and less costly material, namely, of what is called beton.

This beton consists only of small stones, such as are deposited at the bottom of brooks of a rapid current, and lime, which, if poor enough, may be used without mixing any sand with it; if the lime is rich, (contains few other substances but real lime,) one-half of its volume of fine sand may be mixed with it.

A layer of six inches of stone is laid in the form of the basin, well, or other object to be formed; the lime, previously slacked with little water so as to form a rather thick paste, is poured over it, and the stones and lime mixed, not by moving them, but by beating the lime into the space left between the stones with a pointed instrument. This requires some skill, and some time, and some experience, but the specimens I have seen of such work, testify its perfect tightness and great hardness.

The bottom of the vat is first made like any other floor, only in proportion to the size of the vat; then a hollow box of wood of the shape of the interior empty space of the vat, is solidly fixed against the bottom, by fastening it very tightly from above; this is important, as if this inner mould is not fixed tightly, it is subsequently raised and pushed in all directions. Round this inner mould, and at the distance of the thickness to be given to the wall, another box made of board, is gradually built, so as to give space to the workman to fill in and to work the materials. These walls vary according to the size of the vat, between 3 and 6 inches in thickness. They are very smooth and hard, but it requires several weeks to let them dry before they can be used.

In the same establishment, I have seen a large cellar also made of beton. In this case the mould was only dug in the earth, and the bottom placed in it after the earth serving as a mould had been dug out. This cellar is vaulted as artistically as any I have seen before, and costs considerably less than the same construction would have cost built with bricks or with stones, and looks as smooth as if it had been cut out from one soft sandstone.

The hardness of the well-dried beton, is, indeed, as great, or even greater than any other material.

The proprietors have also made all their flooring in the shop with beton, and laid out a good many flues to draw off water, which have been covered also with beton so as to make the floor perfectly even and smooth.

I have no doubt but all kinds of smaller stones might be used for the formation of beton-work, but not all kinds of lime might be found to answer quite well; it should have more of the properties of cement and harden very quickly. To acquire this part of the art may require some study, but, I should think this to be well worth time; the applications of this kind of work are very manifold, and as useful and convenient as economical.

In spite of the crisis in America, in the year 1855 to '56, and the war with Russia, which caused me to expect that manufactures in my native land, (Switzerland,) should rather be suffering, I found quite the contrary. The manufacturers of silks and print-work are as busy as ever, and have of late years extended themselves in a most astonishing degree.

In the establishment of one of my friends, a large silk dyer, I found a practical improvement in the process of removing the color and the gum from the silk to make it fit to receive the color, which, through its analogy with many other chemical processes, deserves attention.

Formerly, the raw silk was simply boiled at a rapid ebullition in soap-water to effect the above mentioned purpose. This had, however, the great inconvenience that the threads of the silk were much tangled together, so that the process of winding the silk afterwards, was quite difficult and attended with loss.

Now, the raw silk is simply suspended in strings on sticks, and a large quantity at once suspended by means of these sticks in a large square box of heavy oak-wood, closed by a heavy lid of the same material, and fastened very tightly by means of screws. The silk is previously immersed in a strong solution of soap, and after the box is fastened, a jet of steam is introduced with a pressure of about 4 atmospheres (60 lbs.) The results thus obtained, are very superior to those attained by the old process, though the new process requires less time and expense.

About 12 years back, before I settled in the United States, I had to furnish to a bleaching establishment in the Canton of St. Galls, the plans for a gas apparatus for wringing cotton goods, which, on visiting there, I have seen now, for the first time in operation.

The gas for such purpose, needs, of course, not to be of illuminating properties, but should yield a very hot flame. This condition caused me to choose a mixture of equal volumes of hydrogen gas and oxide of carbon.

1 Cubic foot of Hydrogen Gas produces		205	units of heat.
1 " Oxide of carbon,	"	207	"
		412	"

The capacity of heat of the products of combustion, viz:

1 Cubic foot Steam,	= 0·029000	0·080869.
1 " Carbonic Acid,	= 0·028942	
4 " Nitrogen,	= 0·022927	

divided into that quantity of heat $= \frac{412}{0{\cdot}080869}$ give the intensity of the flame as 5095° Cent. = 9203° Fah.

Now, the experience of a number of years show, that the production of 3000 cubic feet of that gas mixture, to wit: the firing of two retorts for 12 hours effected with

800 lbs. Wood equivalent to 400 lbs Anthracite, which cost, for instance, in Philadelphia, at $ 5 per ton,	$ 2·00
54 lbs. Charcoal at 1 c. per pound,	·54
Add for labor, interest, and wear and tear,	·83
	$ 3·37
Thus we find the 1000 cubic feet to cost only	1·12

No other gas would cost less, and none would answer as well the purpose, as it is important that no soot be deposited on the goods.

The process by which these results are obtained, and the apparatus used therefor, are very simple.

There are two perpendicular retorts of cast iron, connected by a horizontal tube below the furnace; above the furnace, one of the retorts gives issue to the gases by a common gas pipe. A similar pipe is connected with the top of the other retort and issues from a very small steam boiler, in which steam is generated by the waste heat of the furnace.

Both retorts are filled with charcoal and when these are red hot the steam is admitted. This steam is simply decomposed by the charcoal; the oxygen forms oxide of carbon, and the hydrogen is freed and goes off in equal volumes with the oxide of carbon.

The tops and bottoms of the retorts are provided with lids, constructed like safety valves, so that they may periodically be replenished with charcoal, and the cinders from the consumed charcoal taken out from time to time at the bottom.

These retorts have but six inches diameter; are exposed to the fire four feet high, and are made of cast iron.

It has lately been suggested to procure pure hydrogen from such a mixture of oxide of carbon and hydrogen, by passing the gases through a mixture of quicklime and caustic soda, enclosed also in a red hot tube. In this process the water contained in the caustic soda is again decomposed, its oxygen combines with the oxide of carbon to produce carbonic acid, and the hydrogen is made free. Most of the carbonic acid thus formed combines with the soda, and some that goes through may well be separated by the commonly used means.

There may come a time and the opportunity when such a production of large quantities of free hydrogen may be most desirable, and I have no doubt that such a process may prove practical and sufficiently economical.

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The high price of rags for the manufacture of paper, has of late years, induced many persons to seek for substitutes for this scarce material. Any kind of vegetable fibres has been subsequently suggested. The paper manufacturers in the United States had a still greater inducement to seek for such a substitute, than the Europeans, where rags are to be had at a reasonable price, and therefore, I suppose that great improvements have been made in the former country to that purpose; yet it may be of interest to hear of the exact results and the apparatus which I have seen in one of the most renowned paper-mills in this country.

Very white kinds of wood are here used, not exactly as a substitute for rags, but as a cheap and good material to be mixed in variable proportions with the paper pulp derived from rags.

The machine which reduces the wood to a pulp as fine as the common paper pulp, consists in a large circular stone of about 4 feet diameter and 3 feet thick. It moves on a horizontal axle with a speed of about 12 feet per second. On the front side of the stone a system of screws moved by the machinery are so placed as to press about 12 pieces of wood against the grinding circular surface of the stone. Any of the screws arrests its motion as soon as the wood behind it is scraped off, so that it may be rearranged with a new piece at any time.

From the top of the grinding stone, a tolerably large quantity of water comes in in a jet; this causes the fine particles of wood to be transformed immediately into a thin pulp, which is washed off continuously into a basin below the grindstone.

From the basin the pulp goes through a sieve, which arrests all coarse parts of the wood which might go into the pulp.

The thus purified thin pulp then goes into a square box, in which a hollow cylinder covered with wire cloth is made to revolve. This cloth is of such fineness, that only the coarsest part of the wood pulp is arrested on its surface, and forms there something like a new formed sheet of paper, which, by means of a roller and a scraper, is taken off and collected into a receiver standing behind the cylinder.

All the finer parts of the pulp and the water go through the wire cloth, and are by means well known, collected as a thin pulp in the hollow axle of the cylinder, which pours its contents into a second square box in which another cylinder covered with a somewhat finer wire cloth, separates again those of the wood fibres that come next in size to those separated by the first cylinder. This is repeated five times, so that there are five qualities of wood fibre collected, each different in quality. This separation is required, because the coarser qualities have to be subjected to the action of the common paper engine, where they are mixed with the rag pulp.

The wood engine requires the power of 24 horses, and furnishes in 24 hours, 2400 lbs. of dry good pulp.

24 horse power cost per hour about 192 lbs. to 200 lbs. Anthracite, at $ 5 per ton, ...	·50
This power reduces to pulp 100 lbs. wood, which cost about	·25
Then 100 lbs. of the dry pulp cost, including labor,	·25
	$ 1·00

This is, indeed, cheaper than any kind of rags, and as there is no loss of matter, and the pulp requires no bleaching for most purposes, this substitute is of great practical value.

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Since several years it has been a subject of study to many chemists to produce different preparations from the vegetable fuel called turf.

Most have succeeded in obtaining from the turf a variety of empyreumatic oils, as lubricating oil which has been applied to various purposes, besides this, a small quantity of paraffine is obtained, from which very fine candles are made which resemble much those of sperm. And finally, a residue of a kind of very porous and well burning coke is obtained.

These products, however, are but of small value against the value of the turf itself in those countries where fuel is scarce and dear. It is used with a greater pecuniary advantage as a fuel, so, for instance, all the locomotives of the railroads in Bavaria are fed with dried turf, and as these railroads pass through a good many fields where this material occurs abundantly, it is evident that this employment is advantageous.

However, the turf requires a good deal of time and good weather to become well seasoned; it requires very large store houses to keep it dry and to store it for such seasons when it cannot be dried. The volume of the common turf is very considerable compared with its power as a fuel, and even to make use of it as a fuel, it demands a great deal of labor to the fireman.

Besides these inconveniences, the best seasoned turf has the property to be very hygroscopic, a quality which lessens much its heating power. It contains 30 to 40 per cent. of water, which on being evaporated when brought into the fire place, absorbs great quantities of heat which escapes with the steam through the chimney.

The attempt to reduce the volume of the turf, to make it less porous, and hence less hygroscopic, has been made frequently, but many times with questionable success. The administration of the Bavarian railroads have caused a great many experiments to be made ; they have chiefly applied themselves to effect the desired end by pressing the turf by means of powerful hydraulic presses, but found that this was too slow and expensive.

In the regions of the river Aar in the western part of Switzerland, there are very extensive turf fields, so extensive that they are almost worthless, though the turf be of good quality. But as there is very little manufacturing industry the value of this voluminous fuel is very limited.

I have seen there an establishment not yet at work, which has been formed by a joint stock company with a capital of 150,000 francs, and which proposes to manufacture from the raw turf a kind of fuel which has only $\frac{1}{6}$th of its original volume and is so very hard and compact, and without the property to absorb moisture from the air, that one may indeed, expect the most favorable results from this enterprise as this prepared fuel may well support the freight to places where fuel is more in demand.

The means of making such a beautiful condensed turf as is shown by samples, are very simple; they consist simply in reducing the turf to a fine pulp, to strain the pulp through a fine sieve, to dilute it with sufficient water to allow the earth and fine sand mixed in the raw turf, to deposit themselves at the bottom and to conduct the pulp in large reservoirs where the water goes off, and to mould the very thick pulp like bricks without pressure, and finally, to dry these bricks first in the open air and then in a hot place.

I will try to describe the machinery which is nearly completed for that purpose.

To render the transport of the raw turf to the place where it is manufactured as cheap as possible, canals are cut in the ground leading from the places where the turf is dug to the place where it is manufactured ; the raw material is then very easily conveyed to the place where it is wanted. Behind the working machinery, and reaching into the boats in which the material has been deposited, goes a hoisting-machine which, with the help of a man, carries the material from the boat to an elevation of about 20 feet, where it drops its charge into a sort of a funnel.

Below this funnel, are two cylinders armed with nails or spikes standing out from the circumference, these being placed and contrived so as to move in opposite directions, tear the soft and wet turf into small pieces.

These small pieces fall down upon another cylinder which revolves also in a large flue which forms a continuance of the funnel. This cylinder at its circumference is armed with a large number of curved blades of steel, which strike in their revolution against one projecting horizontal blade, with which they effect something like the cut of a pair of scissors. Above this cutting apparatus a stream of water is introduced from both sides of the funnel, so as to clean the cylinder and to suspend the particles of the turf so as to form a pulp. From beneath this second cutting cylinder, the funnel is divided in two branches which lead the pulp in two cylindrical boxes. These are made of sheet iron and are each formed of two cylinders of which one is placed within the other, so as to leave an empty space of a few inches between. The surface of the inner cylinder is perforated by small holes, a perpendicular axle bearing four wings is moving rapidly in this inner box and causes by its motion all the fine particles of the pulp to go through the above mentioned small holes, whereas all coarser parts remain in the interior and may be removed from time to time. The outer box of course, serves as a receiver for the fine pulp and communicates, by pipes with very large vats, which receive the pulp at about the middle of their height. In these vats there are also perpendicular axles and wings which keep its contents in motion; to facilitate this motion a certain quantity of water goes through the axle and is introduced from below. At the upper rim of these vats a circular receiver surrounds the vat, into which the contents of the vat overflow constantly. The chief purpose of these vats is to dilute the pulp sufficiently to cause the sand and earth to separate from the vegetable matter and to deposit itself to the bottom.

From the outer rim which receives the overflow, a series of flues lead the thin pulp into very large reservoirs dug in the ground, where the excess of water partly evaporates and partly goes through the bottom. These reservoirs are about 3 feet deep, 50 feet in length, and 25 breadth.

Round these reservoirs are very light wooden buildings with shelves, for the purpose of receiving the pieces of manufactured turf and of drying them by the common draft of the air. These pieces are made from the pulp after it has taken sufficient consistency in the reservoirs, and are formed exactly as bricks are formed from clay.

After the turf bricks have sufficiently dried in the air, they are removed to a hot dry-room where they acquire full hardness, so as to be ready for sale.

The whole machinery is moved by a steam engine of 15 horse-power.

What amount of manufactured turf will the power of 15 horses furnish? This is now the great question!! I shall not anticipate the soon expected results, by any opinion, but the samples of this new preparation are so fine that they excite the most partial expectations, and the whole business is well worth the attention of all who care for improvements in the arts.

Close to this establishment, there is an opposition one. There the newly dug turf is simply ground between two stones like those used for grinding fruit for the manufacture of cider. The paste which issues between the two stones is immediately formed into bricks and simply dried in the open air.

I do not know what amount of power is consumed to produce a certain quantity of manufactured turf. The samples I have seen of this preparation keep the mean between raw turf and the produce of the above described establishment; they are still porous but tolerably hard, and may as a fuel answer tolerably well.

In the neighborhood of these establishments, I visited also, some old friends who are paper manufacturers. There I saw a new construction of steam boilers, manufactured by Bryan, Donkins, & Co., London, which I will describe as a curiosity. The boiler has two interior fire places at each opposite end of the cylinder, which is the shape of the boiler.

These fire boxes, however, are rather small and take up only one-fourth of the circular bore of the cylinder; they are exactly opposite to each other, so that the flames go in opposite directions and meet in the middle of the boiler; then both currents mix and are directed towards the bottom of the boiler, on the bottom the flue turns on the other side of the boiler, and divides itself again in opposite directions and goes through a system of pipes which issue both at opposite ends of the boiler from where the gases of combustion are again re-united in the chimney.

Machinists are as fond of, and as subject to, fashion and change of dress as ladies; in this instance, at least, I cannot discover what advantage is gained by making complicated what we know to answer better if made simple.

(To be Continued.)

For the Journal of the Franklin Institute.

Remarks on the Gyroscope.

The remarks of your correspondent, Mr. Allen, in the last number of the *Journal*, on the subject of the Gyroscope—although apparently, in the main correct, and the best explanation I have yet seen of the instrument, are not, in all respects, consistent with the facts of the case.

It is, no doubt, the "inertia of the plane of rotation," that keeps the instrument in its place during the rotation of the wheel. The action of this force is easily proved by holding it in the hand when in rapid motion. The resistance it offers when an attempt is made to change the plane is very perceptible.

Your correspondent says, "the tendency of the instrument to rise does not overcome the force of gravity, does not quite equal it." On the contrary, in the instrument I possess, this tendency overcomes gravity so completely, that it sometimes assumes a position so nearly vertical as to slip off the point of suspension.

If this tendency is increased in proportion, as gravity is overcome by the increased rapidity of the rotation at the wheel, an infinite rapidity ought to elevate it much above the horizontal position, which he asserts would be the one assumed.

The revolution of the instrument upon its point of suspension, is evidently the result of the combined forces of gravity and centrifugal force.

For if gravity is counteracted by other means, such as the suspension of a weight from the extended arm upon which the instrument revolves so as to balance it, the orbicular motion will cease.

Another peculiarity to which your correspondent does not allude, is the increased revolution upon the point of suspension in proportion to the decrease of the revolution of the wheel, as if it was essential that one's gain should compensate for the other's loss in keeping the whole suspended.

In case of gravity being counteracted, as before alluded to, the wheel being in motion, the orbicular motion ceases.

If, however, this motion be artificially produced, a force similar to, and in the direction of gravity is immediately the result, drawing the instrument or the balance downwards, according to the direction of the force applied, showing that two of the motions cannot exist without the third being produced. W.

Germantown, 6 *mo.* 18, 1856.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, June 19, 1856.

John Agnew, Vice-President, in the chair.

John F. Frazer, Treasurer.

Dr. B. H. Rand, Recording Secretary, pro tem.

The minutes of the last meeting were read and approved.

Letters were read from the Royal Imperial Geological Association, Vienna, Austria; and from the Royal Society of London.

Donations to the Library were received from the Royal Imperial Geological Association, Vienna; The Institute of Actuaries, London; Hon. Job R. Tyson, U. S. Congress; Major W. H. Emery, U. S. Top. Eng., Washington, D. C.; Trustees of the Free Library, New Bedford, Mass.; The Mercantile Library Association, City of New York; The Managers of the State Lunatic Asylum, Utica, New York; The Philadelphia Library Company, Dr. L. Turnbull, Messrs. Philip Price, and George W. Conarroe, Philadelphia.

Donations to the Cabinet of Minerals from Mr. Isaac H. Conrad, Philadelphia, and Capt. Samuel W. Dewey, Patrick Court-House, Virginia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of May.

The Board of Managers and Standing Committees reported their minutes.

The candidates for membership in the Institute, (4,) were proposed, and the candidates proposed at the last meeting, (5,) were duly elected.

Mr. Howson exhibited the model of an improved coal screen, invented by Mr. Isaac Harman, of Tamaqua, Pennsylvania, for which he has applied for a patent. The object of this invention is to avoid the use of a central shaft, with arms on which coal screens are usually suspended. By resting each end of the screen on the V shaped pulleys, it is retained in its proper position, although set at an angle of about one inch vertically to twelve inches horizontally; at the same time a rotary motion is easily imparted to the screen by turning a shaft, and without the intervention of ordinary gearing. By this arrangement no obstacle is offered to the introduction of masses of broken coal to the interior of the screen.

Another feature of this invention, is the introduction of a series of projections cast on the interior of the gratings, which have the effect of partially retarding the broken coal in its progress through the screen; thus allowing the smaller particles every opportunity to pass through the openings in the grating.

Mr. Howson also exhibited the model of a machine for making pressed brick, invented by the same gentleman, and for which, application has been made for a patent.

This invention may be briefly described to consist in the employment for making bricks of sliding moulds, constructed in two halves, each half having any convenient number of angular recesses and projections. A horizontal reciprocating motion is imparted by means of a crank to the moulds, which are arranged to slide in suitable guides.

In addition to the reciprocating motion, the two halves of the guides are caused (during certain points in the movements of the machine,) to separate from, and come in contact with each other; the points of the angular projections of the two halves of the moulds always coinciding, so that the angular recesses of the halves, together, form oblong spaces of the form and size of the bricks to be manufactured.

A knife is used in connexion with the moulds, and so operated by means of rods and levers, that the moment the moulds are supplied with tempered clay, all communication between them and the reservoir above is cut off.

To the under-side of one-half of the moulds, is hinged a radial plate, so arranged in connexion with levers and latches, as to open and close during the movements of the machine, when closed forming the bottom for the moulds, and when open allowing the bricks formed in the moulds to escape therefrom; and to the upper-side of one-half of the moulds, is hinged a radial lid, having a plate with projections corresponding in shape to the spaces formed by the angular recesses of the moulds. This lid is alternately raised and lowered during the movements of the machine, raised when clay has to be admitted, and lowered so that in conjunction with the above-mentioned radial plate, the clay may be confined to the moulds at the time the two halves of the latter are brought together.

It will be understood, that the principal feature in this machine is the arrangement of the moulds, which expand when the clay is first admitted, and afterwards contract so as to condense the clay confined in the moulds, above and below, into a compact mass, making pressed bricks of a superior quality, and at a rapid rate.

Mr. James Dougherty, called the attention of the Institute to a mode of melting iron shavings, borings, or turnings, patented by Mr. Abiel Pevey, of Lowell, Massachusetts.

It consists in the use of cast iron vessels, of any convenient form, into which the shavings are closely packed and secured by a lid. They are then ready for use, and may be charged into the cupola with other iron, in any desirable quantity. The kind of vessel used by Mr. P., is a cylindrical pot with a tube through the centre, (which was exhibited,) and is a very convenient form.

The re-melting of iron shavings has always been a desideratum with those whose operations produce them in large quantities; but attempts heretofore made to melt them in open cupola, have been very unsatisfactory. They are blown away, and oxidized by the blast; the waste is very great, and the iron hard and inferior.

This is a very practical plan: the vessels are easily made, at a very small expense, and no part of the process requires more than ordinary care. The work can be done by any one, and the pots when filled are quite equal to the best scrap iron, and as readily handled. Each pot will hold 110 lbs., and cost about 15 cents or three dollars per ton.

The loss is not more than that of other scrap iron, or about 10 per cent.

This process is in successful use at a number of foundries in the neighborhood of Lowell, and at the Industrial Works of this City, and is giving entire satisfaction. In castings made with from one-fourth to one-third shavings, the grain of the iron is improved, it is closer, will finish better, and works well under the tool. A piece of casting was shown which was one-third shavings and two-thirds pig. The grain is very close, almost equal to wrought iron, while the iron is soft and strong.

Mr. Pevey's mode must prove valuable to parties producing large quatities of shavings.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Linus Yale, Jr's., Improvement in Locks for Banks, Safes, and Doors.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "an Improvement in Locks for Banks, Safes, and Doors," invented by Linus Yale, Jr., late of Newport, Herkimer County, New York; now of Philadelphia, Pennsylvania—Report:

That they have examined carefully the construction of this important improvement, and find it to be, briefly, of the following described construction and arrangement:

A circular key-hole, with a small slot or notch, permits the introduction of a key with a square pin on the stem, by which the various movements are made in the act of turning it round. No other opening is presented in the lock; when the revolution of the key commences after its insertion, a pod is separated, carrying the bits with which it is furnished, to another part of the interior of the lock, and at the same time covering the hole by which it had been inserted with a steel plate; a continuation of the movement, then presses the tumblers in their carriage, against the bits of the key-pod, and adjusts them to the proper position to receive the fence-tumblers, which, when so adjusted, permit a cross-head to be slid into position with the fence-tumblers, and with it a "bolt dog," which lies behind the bolt-frame, so as to allow their withdrawal by a further movement of the key. The conclusion of the revolution of the key, brings the key-pod to its original place, where it is attached by a dowel and dove-tail, and may be withdrawn in the same condition in which it was inserted.

They key has eight bits capable of change, in relative position, and may further be reversed, so that the permutation principle is carried to an extent that, if calculated, might possess interest to those who are fond of a long array of figures. It is sufficient for our purpose to say, that it is too near infinity to offer any inducement to manipulation by several successive generations of mankind.

It is believed that this general description of the movements of this lock is all that is needed, for it is perfectly evident that no description, without the aid of diagrams or models, could render its construction and movements intelligible; let it suffice therefore to say, that a reverse action locks and secures the bolts, and a change in the bits of the key, adjusts the tumblers and fence-tumblers, and locks and unlocks them, when so adjusted, and prevents the use of the key when disarranged.

In the opinion of the Committee, this lock possesses merits of the highest order, and gives as much security as it is possible by human ingenuity to confer upon such means of protection. The reasons which have guided the Committee to this result, are as follows:

A small sized and conveniently portable key. A simple circular key-hole, affording little or no opportunity to insert any means of feeling, measuring, or impressing by sweeping or otherwise. The separation of the pod, with its bits, and its removal to another part of the lock, rendered inaccessible by the sliding of a plate over the aperture by which it had entered. So much for security. The Committee further consider this lock to be of superior construction, from the entire absence of all springs; one only, of the least objectionable kind being contained in the key.

The permutation arrangements give perfect security as far as that principle is concerned.

Finally, the workmanship of the lock, which we have examined, is of a superior order, and is in itself a recommendation of no ordinary merit.

For these reasons the Committee are of opinion that the lock of Mr. Linus Yale, Jr., of Philadelphia, is the most perfect in its principles, and best in execution that has come under their notice; and that it will be found invulnerable, even to the hands that have succeeded in removing the supposed security of its far-famed predecessors.

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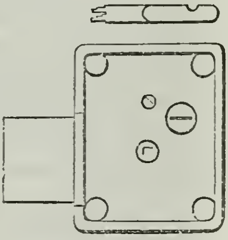
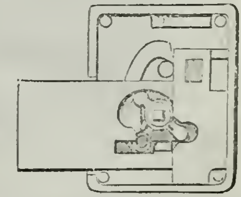




The Committee also examined a small economical lock, presented to their notice by Mr. Yale, and found it to consist of a box, enclosing a carriage, sustaining and carrying a set of five tumblers, which carriage is moved by cams, upon a spindle with an exterior knob. The key-hole is a mere slit, about $\frac{1}{16}$th of an inch in width, giving entrance to a flat key, with the wards upon the end. These being of unequal height depress the tumblers to the proper adjusted position, and allow the turning of the handle or knob to set the carriage in motion, thus carrying away the tumblers, and at the same time closing the key-hole, by sliding over its aperture, it being necessary to remove the key previous to any other movement, the carriage is then put into a position which will allow a further movement of the handle to draw the door bolts.

A reverse action of the knob, returns the carriage and door bolts, and an ingenious inclined plane or guide, re-sets the tumblers to their original place, and the door is thus locked.

This lock, like the preceding, but more expensive and elaborate arrangement, combines principles that appear important: that of removing the tumblers from their original position, and closing the aperture or key-hole, creating in this respect a marked feature of security. It is also free from the inconvenience and liability to derangement of springs, being entirely without them.

It is true, that the permutation principle is not embraced; nevertheless, we are of opinion, that it is an ingenious, economical, and very secure lock; and is worthy of the very highest commendation for its combined qualities.

By order of the Committee,

Philadelphia, June 12, 1856. Wm. Hamilton, *Actuary.*

Description by the Inventor.

Fig. 1 is a plan of the lock in the unlocked position. Fig. 2 is a section of the same through the line I I, from above, with the key-tumblers in their normal position. Fig. 3 is the same, showing the key-stem in the key-hole, the inner key-hole closed by the hard plate *m* ; the key-bits carried into the lock, and the key-tumblers impressed by them ; the

Fig. 1

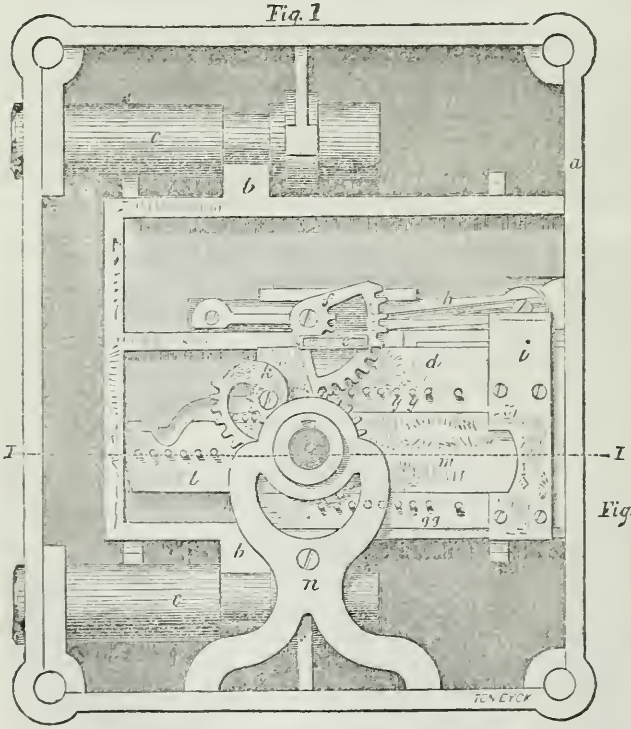


Fig. 7

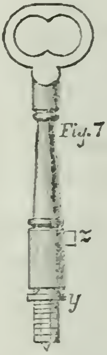


Fig. 11

Fig. 8

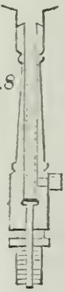


Fig. 9

Fig. 10

cross-head i is also shown in contact with the driving wheel f. Figs. 4, 5, and 6 are plans of the tumbler carriage d, with the hard plate m, and cross-head i removed to show the tumblers. In Fig. 4 the key tumblers r, and fence-tumblers s, are shown in the unlocked or normal position, held immovably in their place by the pin a', which is attached to the hard plate m. The key-bits x, are shown as just inserted, ready to be impressed against the tumblers. Fig. 5 the key-bit in place, with the key-tumbler r, pressed into it, the fence-tumbler s, as arranged by the key-tumbler now moved away from it, and held immovably by the knife-edge t, which has now entered that one of its notches which corresponds with the length of the key-bit used. This plan shows the arrangement of the tumblers when the inner key-hole is closed, corresponding to Fig. 3. In Fig. 6 the true-tumbler s, fastened by the knife-edge, in the position given it by the key-tumbler r, in locking; the latter as carried to its normal position, where it must always remain immovable when the external key-hole is open: the key is now withdrawn.

Fig. 2

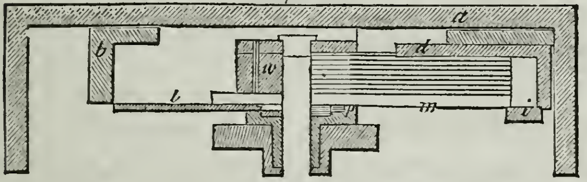


Fig. 6

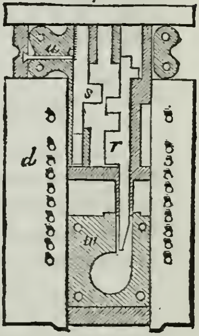


Fig. 3

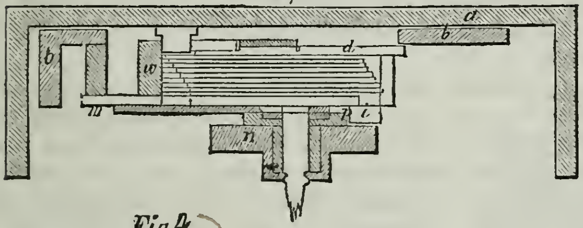


Fig. 4

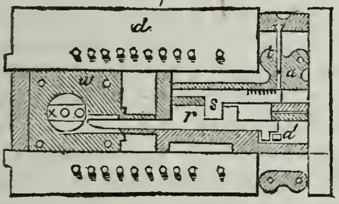


Fig. 5

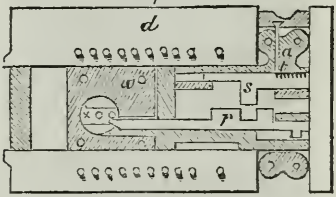


Fig. 7 is the key; z, the square pin or handle, which turns the driving wheel; y, the key pod attached to the handle by a dove-tail and spring dowel. Fig. 8 is a section of a key, showing spiral spring in handle, and spring dowel to keep the pod from slipping off. Figs. 9 and 10 show the dove-tailing of the end of the handle, and the key were they unite.

Fig. 11 is a key-bit with centre hole to pass over the centre pin, also hole for the screw to hold it with the others on the key-pod.

Fig. 12.

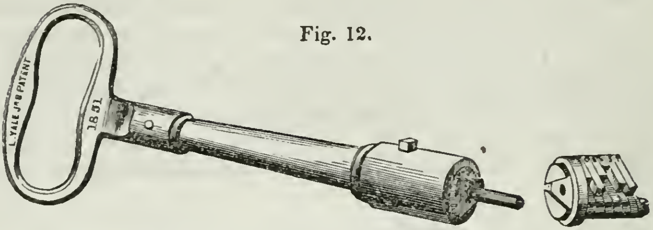
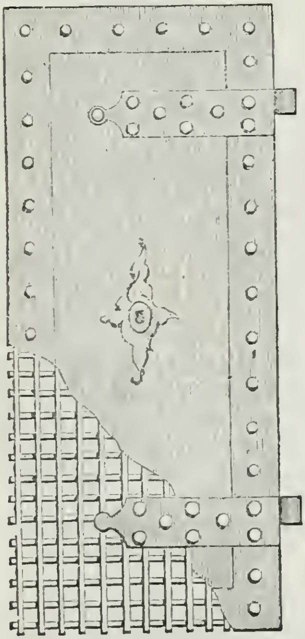


Fig. 12 is a perspective view of the key with the pod of bits shown detached, ready to be carried into the lock.

Report on Yale's Iron Bank Doors, Vaults, and Safes.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "the Chilled Iron Bank Doors, Vaults, and Safes," invented by Linus Yale, Jr., late of Newport, Herkimer County, New York.; now of Philadelphia, Pennsylvania—Report:

That they have examined the drawings and illustrations submitted, and find that the plan or system, arises out of a combination of chilled or hard iron, and wrought or tough iron, in a woven or basket form; thus guarding against the destruction of the first by blows of a sledge, or the cutting away of the latter by quieter but more insidious efforts, and thus giving increased security to the places of deposit of valuables, against the usual means of depredation.



The arrangement is so evidently an important improvement, that the Committee have no hesitation in giving the invention a high estimate of consideration, and a recommendation of it to those who need protection, which it will undoubtedly give against violence, or the quieter but more dangerous use of cutting instruments; and thus by the combination of hard and tough materials, presenting difficulties to depredation almost, if not quite, insuperable.

By order of the Committee,

Philadelphia, June 12th, 1856. Wm. Hamilton, *Actuary.*

BIBLIOGRAPHICAL NOTICE.

Report of Explorations and Surveys to ascertain the most Practical and Economical Route for a Railroad from the Mississippi River to the Pacific Ocean, made under the direction of the Secretary of War, in 1853-4. Vol. I, 4to; pp. 651.

The plan of a railway from the Atlantic to the Pacific Ocean across the Continent, moves like a magnificent vision before the American mind. It seems a necessity to chain together by it the two parts of the Empire, which now, are divided by an immense expanse of country. This scheme has awakened the public interest, and undergoes now, after a general discussion, a closer investigation. Before us lie the reports of explorations and surveys made by order of Congress, to ascertain the most practicable and economical route for a railroad from the Mississippi River to the Pacific Ocean. There were five different routes investigated with the following results :

1. Route near the forty-seventh and forty-ninth parallels.

The advantages of this route are—its low profile, which is important in relation to climate ; its easy grades and small amount of ascents and descents ; the great extension west of the prairie lands for the supply of timber over the western half of the route; the facilities which the Columbia River and Missouri will afford to the construction of the road; in the short distance from the Mississippi to a sea-port of the Pacific, (1864 miles to Vancouver); in the western terminus of the road on Puget Sound, being nearer to the ports of Asia, than the termini of the other routes; in the proximity of the eastern terminus to Lake Superior, and in the existence of coal on Puget Sound.

Its disadvantages are—the difficult and costly construction, including a long tunnel through a mountain region of 550 miles ; the high freshets of the rivers which are to be passed; the severe and long winters; the distance of its western terminus from San Francisco ; the proximity of the whole route to the English possessions.

2. Route near the forty-first and forty-second parallels.

Its advantages are—comparatively cheap construction owing to the low run of ascents and descents ; the probability of large coal fields in the middle of the route; the proximity of Utah.

Its disadvantages are—the very difficult and costly constructions along the Sacramento River, through the cañon of the Timparogos, through the Black Hills to the South Pass ; in the great elevation of the summits in the Rocky Mountains, and of its plain ; the long and severe winters, and the snows on it.

3. Route near the thirty-eighth and thirty-ninth parallels.

No peculiar advantage was developed in the exploration of this route, except the probability of the existence of extensive coal fields in the valleys of the Grand and Green Rivers.

The extraordinary difficulties to be overcome from the Coo-che-to-pa Pass to the Great Basin, (500 miles,) render the route impracticable.

4. Route near the thirty-fifth parallel.

The advantages of this route consist in a greater supply of water, fuel, and timber; in the greater mildness of the climate; in no tunnels required; and in the assistance to be had from the population of New Mexico and the Mexican provinces.

The disadvantages are—its greater length from the Mississippi to the Pacific, than the route south of it; the apparently rough and broken character of the country; its much greater cost, and the greater number of ascents and descents, the sum of which is the greatest of the four routes.

5. Route near the thirty-second parallel.

Its advantages are—the short distance from the eastern terminus to a Pacific port, (1618 miles,) the small cost of the road, it being to a Pacific port less than two-thirds of the cost of the cheapest of the other routes, and to San Francisco $ 20,000,000 less than the cost of the others, (the cheapness of construction being due to the location of the route upon more than 1000 miles of table lands and plains;) in the favorable features of the mountain passes; in the mildness of the winters and the proximity of population in New Mexico and the Mexican provinces.

Its disadvantages are—the cost of construction of a portion between the Petos and Rio Grande; the circuitous route to San Francisco from the plains of Los Angelos, which, unless further explorations determine a more direct route, requires a second crossing of the coast range, and a passage through the Sierra Nevada; in the sum of ascents and descents being the next largest after that of the thirty-fifth parallel; and, finally, in the scanty supply of water and fuel on the route.

These five routes have, then, it seems, the following points in common: they lead through a country barren in general, both in its low and more elevated parts; more or less deficient in material for building, even in wood and water, and clearly more a grazing country than an agricultural one. The population, therefore, will always be thin, of a nomadic character, and little fit for supporting railway traffic. All the reports agree in the opinion, that the obstacles are great, but not insurmountable. A railway, therefore, might be built over any of these routes, but it would cost immense sums; by far greater than any other railway in the world; and the expenditure of such sums would only be warranted by the most urgent necessity. Does this necessity exist? The direct route from the great Atlantic Cities to San Francisco, by railway, would be 4000 miles; the route by sea, over the Isthmus is 6000 miles; thus the gain would be one-third the distance on the sea route. If the advantage of sea transport over transport by railway was one-third, both modes of transport would balance each other. But every one knows that sea transport has the advantage over land transport in a far higher ratio than one-third. The alleged propriety of sending our mails and goods through our own territory loses much of its power, if we consider that the United States get more and more control over the Isthmus. If we want a quicker communication with the West Coast, it seems more practical to look for shorter routes over the Isthmus, and for improvements in the system of our navigation, than to commence building a railroad in a yet almost unknown, and for such an enterprise certainly always unfavorable country, with the probability of seeing the work stopped in an unfinished state, but after the expenditure of enormous sums of money. Th. P.

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FOR THE

PROMOTION OF THE MECHANIC ARTS.

AUGUST, 1856.

CIVIL ENGINEERING.

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*The Resistance of Flexure: On the existence of an element of Strength in Beams subjected to Transverse Strain, arising from the Lateral Action of the fibres or particles on each other.** By William Henry Barlow, F. R. S.

(Continued from page 10.)

The foregoing experiments having shown that in girders containing the same depth of metal, the resistance arising from the lateral action of the particles depended on the amount of the flexure, I thought it desirable to make other experiments to ascertain how this resistance varied in girders having the same total depth, and consequently nearly the same deflection, but with different depths of metal in the girder. For this purpose, beams were cast of the forms Nos. 5, 6, and 7, each 4 inches deep, and with the upper and lower ribs, $1\frac{1}{2}$ inch by $\frac{3}{4}$-inch, the ribs being placed so that the depth of the metal in No. 5 was twice as great as in Nos. 6 and 7.

Four beams were cast of each form,—the exact dimensions and breaking weights are given in the Appendix,—and the mean results were as follows:—

Description of beam.	Depth of beam.	Depth of metal.	Sectional area.	Deflection.	Breaking weight.
Form No. 5,	4·04	3·01	2·320	·322	5141
Form No. 6,	4·04	1·48	2·230	·310	5147
Form No. 7,	4·07	1·56	2·380	·262	6000

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* From the Lond. Civ. Eng. and Arch. Journ., May, 1856.

Obtaining the value of F from these experiments, and comparing them with beam No. 4, which had the same total depth, we have—

	Deflection.	Depth of metal.	Value of F.
Form No. 5,	·322	3·01	37,408
Form No. 4,	·301	1·97	28,032
Form No. 7,	·262	1·56	27,908
Form No. 6,	·310	1·48	25,271

The experiments did not afford so complete a comparison as the former series, because the intervals between the vertical ribs were not equal, nor in the same proportion to the depth of metal, the effect of which would be to vary to some extent the form of the curve of deflection. Nevertheless, they show in an equally decided manner, that when the deflection is the same the resistance increases when the depth of metal in the beam is increased.

The foregoing experiments have therefore elicited three facts as regards beams formed of two parallel bars separated at given intervals by vertical ribs :—

First, that in every case the resistance, or the value of F, is greater than that due to the tensile resistance of the metal.

Second, that with the same depth of metal in the beam, and the same distance of bearing, the resistance is greater when the deflection is greater.

Third, that with the same deflection and the same length of bearing, the resistance is greater when the depth of metal in the beam is greater.

And it follows from these results, that there is an element of strength depending on the amount of deflection in connexion with the depth of metal in the beam, or in other words, dependent upon the degree of flexure to which the metal forming the beam is subjected.

The existence of an element of strength in addition to the resistances to direct tension and compression being clearly proved by these experiments, it becomes interesting to ascertain the law under which it varies, in the form of beams experimented upon.

Now, if from the value of F, the tensile strength of the metal is deducted, it will be found that the remainder maintains nearly a constant ratio in each case to the depth of the metal in the beam multiplied by its deflection. It would appear, therefore, that the total resistance, or the value of F, is composed of two quantities; one being constant and limited by the resistance to direct tension, and the other varying directly as the degree of flexure to which the metal forming the beam is subjected.

The applicability of this simple law may be tested by the results of the experiments as follows :—

Let $\phi =$ the resistance to flexure in the solid beam at the time of rupture.
and let $D =$ the depth ;
$\delta =$ the deflection ;
$f =$ tensile resistance ;
and $F =$ total resistance.

Then in the solid beam

$$f + \phi = F\,;$$

and let F', D', and δ', represent the total resistance, depth of metal, and deflection of any other of the beams ; then, the lengths being equal, if the resistance arising from the lateral action varies as the depth of metal into the deflection,

$$F' = f + \phi\,\frac{D'\,\delta'}{D\,\delta}.$$

The value of ϕ may be determined from this equation, applied to each of the experiments, in two ways; first, by supposing f to be a constant quantity; and, secondly, by supposing f and ϕ to have a constant ratio.

By the first mode, the whole of the errors of observation and irregularities of the strength of the metal would be accumulated in ϕ. By the second method, these irregularities will be divided between the values of f and ϕ.

Adopting, therefore, the second method, let 1 to m represent the ratio of f to ϕ: then

$$f = m\,\phi,$$

and $$m\,\phi + \phi\,\frac{D'\,\delta'}{D\,\delta} = F';$$

or $$\phi = \frac{F'}{m + \frac{D'\,\delta'}{D\,\delta}},$$

which ought to be a constant quantity in all the experiments.

We cannot obtain the deflections at the line of rupture, but they may be assumed to be proportional to the deflections with $\frac{9}{10}$ths of the breaking weights in each case.

Now, the value of F in the solid beam was found to be 41,709 lbs.; and the value of f, from the experiments on direct tension, was 18,750 lbs.: and as in the solid beam

$$f + \phi = F,$$

ϕ will be 22,959 lbs.,

and the ratio of ϕ to f will be as 1 to ·81.

For the purpose of comparison, I have deduced the value of f and ϕ, in solid beams, from the experiments of Mr. Hodgkinson on ten different descriptions of metal; the results of which are given in the following table (See p. 76):—

The mean ratio of ϕ to f in these metals appears to be as 1 to ·78. The metal used in my experiments was a mixture consisting of two-thirds of South Staffordshire No. 3, hot blast pig, and one-third old metal recast. As compared with Mr. Hodgkinson's experiments, its strength accorded nearly with that of the Carron iron No. 3, hot blast.

The mean ratio of ϕ to f, obtained from Mr. Hodgkinson's experiments, being as 1 to ·78, and from the experiments herein detailed being as 1 to ·81, we may consider f to be four-fifths of ϕ; and therefore

$$m = \cdot 8.$$

Using the ratio, the values of ϕ and f, derived from the formula

$$\phi = \frac{F}{m + \frac{D'\,\delta'}{D\,\delta}}$$

and $$f = \phi\,m,$$

as applied to each of the experiments, are given below :—

$$\text{No. 1.}\quad \phi = \frac{41709}{\cdot 8 + \dfrac{2\cdot 012 \times \cdot 670}{2\cdot 012 \times \cdot 670}} = 23{,}171 \text{ lbs.}, f = 18{,}537 \text{ lbs.}$$

$$\text{No. 2.}\quad \phi = \frac{35336}{\cdot 8 + \dfrac{1\cdot 97 \times \cdot 510}{1\cdot 348}} = 22{,}904 \text{ lbs.}, f = 18{,}323 \text{ lbs.}$$

$$\text{No. 3.}\quad \phi = \frac{31977}{\cdot 8 + \dfrac{2\cdot 01 \times \cdot 401}{1\cdot 348}} = 22{,}890 \text{ lbs.}, f = 18{,}312 \text{ lbs.}$$

$$\text{No. 4.}\quad \phi = \frac{28032}{\cdot 8 + \dfrac{1\cdot 97 \times \cdot 301}{1\cdot 348}} = 22{,}606 \text{ lbs.}, f = 18{,}085 \text{ lbs.}$$

$$\text{No. 5.}\quad \phi = \frac{37408}{\cdot 8 + \dfrac{3\cdot 01 \times \cdot 322}{1\cdot 348}} = 24{,}626 \text{ lbs.}, f = 19{,}501 \text{ lbs.}$$

$$\text{No. 6.}\quad \phi = \frac{25270}{\cdot 8 + \dfrac{1\cdot 48 \times \cdot 310}{1\cdot 348}} = 22{,}167 \text{ lbs.}, f = 17{,}734 \text{ lbs.}$$

$$\text{No. 7.}\quad \phi = \frac{27908}{\cdot 8 + \dfrac{1\cdot 56 \times \cdot 262}{1\cdot 348}} = 25{,}302 \text{ lbs.}, f = 20{,}242 \text{ lbs.}$$

Description of iron.	Transverse strength of bar 1 in. sq. and 54 ins. between the supports.	Tensile strength per sq. inch.	Value of $f+\phi$ from the formula $w=\frac{2ad\,(f+\phi)}{3\,l}$.	Value of ϕ from the formula $w=\frac{2ad\,(f+\phi)}{3\,l}$. $\phi=\frac{3\,lw}{2\,a\,d}-f$.
	lbs.	lbs.	lbs.	lbs.
Carron iron No. 2, cold blast,	476	16,683	38,556	21,873
“ “ “ 2, hot “	463	13,505	37,503	23,998
“ “ “ 3, cold “	446	14,200	36,126	21,926
“ “ “ 3, hot “	527	17,755	42,687	24,932
Devon “ “ 3, “ “	537	21,907	43,497	21,590
Buffery “ “ 1, cold “	463	17,466	37,503	20,037
“ “ “ 1, hot “	436	13,434	35,316	21,882
Coed-Talon “ 2, cold “	413	18,855	33,453	14,598
“ “ 2, hot “	416	16,676	33,696	17,020
Low Moor “ 3, cold “	467	14,535	37 827	23,292
Means, ...	464	16,502	37,616	21,114

These results, though not exhibiting a complete regularity, are sufficiently uniform to indicate that the assumed law of the variation of this resistance is a close approximation to the truth. It will be observed also, that Nos. 2, 3, 4, and 6, give a smaller value of ϕ than Nos. 1, 5, and 7, which probably arises from the difference in the proportion which the distance between the vertical ribs bears to the depth of the metal, a circumstance which would affect, to some extent, the form of the curve of deflection.

In the formula

$$\Phi = \frac{\text{F}'}{m + \frac{\text{D}'\,\delta'}{\text{D}\,\delta}}$$

$\frac{\text{D}'\,\delta'}{\text{D}\,\delta}$ represents the ratio of the depth of metal in each beam multiplied by its deflection, to the depth of metal in the solid beam multiplied by its deflection. But the deflections, as might have been expected from known laws, were nearly in the inverse ratio of the total depths of each girder; therefore, the degree of flexure, and consequently the resistance to flexure in each, will be nearly as the depth of metal divided by the total depth of the girder, and we are thus enabled to obtain a formula for computing, approximately, the breaking weights of these girders, without first ascertaining their deflection.

Using the same letters as before, we have, for the resistance due to tension,

$$\frac{2a}{3l}\left(d + c + \frac{c^2}{d}\right) f;$$

and for the resistance to flexure,

$$\frac{2\,a}{3\,l}\left(d + c + \frac{c^2}{d}\right)\frac{\Phi\,\text{D}}{d};$$

and consequently, for the united effect of the two resistances,

$$\text{W} = \frac{2\,a}{3\,l}\left(d + c + \frac{c^2}{d}\right)\ \left(f + \frac{\Phi\,\text{D}}{d}\right).$$

I shall therefore conclude these observations by comparing the breaking weights computed for tensile resistance alone, and those obtained from the formula which includes the resistance to flexure, with the actual breaking weights obtained by the experiments, taking the value of

$f =$ 18,750 lbs., and $\Phi =$ 23,000 lbs.

Description of beam or girder.	Breaking weight if resistance depended on direct tensile strength.	Breaking weight computed by the formula, including the resistance to flexure.	Breaking weight as obtained by the experiments.
	lbs.	lbs.	lbs.
No. 1 .	849	1890	1883
No. 2 .	1308	2567	2468
No. 3 .	1808	3287	3084
No. 4 .	2912	4659	4353
No. 5 .	2578	4935	5141
No. 6 .	3819	5533	5147
No. 7 .	4031	5919	6000

The accordance exhibited by the computed and the actual breaking weights, evinces the general accuracy of the formula, as applied to this form of beam; while these results, compared with those computed for direct tensile force alone, show how large a proportion of the strength of cast iron, when subjected to transverse strain, is due to the resistance arising from the lateral action.

It will also be seen that comparisons of the relative strengths of different forms of section, calculated, as has been customary, on the assumption that the resistances are constant forces, or governed by a constant coefficient, must be entirely fallacious.

It was my intention to have included in this paper a similar investigation as to the position of the neutral axis, and the amount of the resistance arising from lateral action of the fibres in wrought iron; but as the experiments will take some time to complete, and as the facts elicited in reference to cast iron are of sufficient importance to render it desirable that they should be made known, I will reserve the examination of wrought iron for the subject of another communication.

APPENDIX.

Girder No. 1.

	Exp. No. 1.	Exp. No. 2.	Exp. No. 3.	Exp. No. 4.
	inches.	inches.	inches.	inches.
Depth, . . .	2·015	2·02	2·073	2·040
Thickness, .	·975	·98	1·030	·990
Area of section,	1·965	1·98	2·135	2·020
Weight applied, lbs.	Deflection.	Deflection.	Deflection.	Deflection.
40	·015	·013	·014	·014
376	·145	·115	—	—
600	·203	—	—	—
712	·280	·233	·264	·244
936	·330	—	—	—
1160	·490	·420	·397	·414
1608	·725	·625	·579	·614
1664	·755	·655	—	—
1720	Broke.	·680	·629	·659
1832	. . .	·737	·679	·734
1888	. . .	Broke.	·699	·764
1916	. . .	. . .	—	Broke.
1944	. . .	. . .	·734	. . .
2000	. . .	. . .	·762	. . .
2028	. . .	. . .	·774	. . .
2056	. . .	. . .	·789	. . .
2084	. . .	. . .	Broke.	. . .
Breaking weight, lbs.	1664	1888	2084	1916
Deflection with 9-10ths of breaking weight, inches,	·643	·667	·699	·670

GIRDER No. 2.

	Exp. No. 1.	Exp. No. 2.	Exp. No. 3.	Exp. No. 4.
	inches.	inches.	inches.	inches.
Total depth, .	2·54	·253	2·49	2·50
Depth between upper & lower ribs,	56	·55	·51	·55
Area of top rib,	1·00	1·00	·57	·98
" bottom "	1·01	1·00	·99	·97
Weight applied, lbs.	Deflection.	Deflection.	Deflection.	Deflection.
40	·009	·007	·007	·007
712	—	·132	·132	·137
804	·199	—	—	—
1292	·304	—	—	—
1516	—	·302	·319	·312
1740	·414	—	—	—
1852	—	·372	—	—
1964	·489	·397	·426	·433
2076	—	·427	—	—
2188	Broke.	·445	·479	·487
2300	. . .	·479	·526	·532
2412	. . .	·512	Broke.	·550
2524	. . .	·542	. . .	Broke.
2636	. . .	·575		
2748	. . .	Broke.		
Break'g weight, lbs.	2188	2748	2412	2524
Deflection with 9-10ths of breaking weight, inches.,	·489	·532	·482	·516

GIRDER No. 3.

	Exp. No. 1.	Exp. No. 2.	Exp. No. 3.	Exp. No. 4.
	inches.	inches.	inches.	inches.
Total depth, . .	3·02	3·00	3·00	3·00
Depth between upper and lower ribs, .	·98	1·00	1·01	1·01
Area of top rib, .	1·03	1·02	·97	1·01
" bottom " . .	·99	·98	1·01	·97
Weight applied, lbs.	Deflection.	Deflection.	Deflection.	Deflection.
40	·006	·005	·005	·005
712	—	·085	·085	·085
844	·113	—	—	—
1516	·216	·185	·197	·195
1740	·248	—	—	—
2188	·328	—	·297	·293
2300	—	·295	—	—
2524	·388	—	—	—
2636	·418	—	·363	·375
2748	·433	·377	—	—
2972	·483	·410	·423	Broke.
3028	Broke.	·425	·438	
3084	. . .	·435	·452	
3112	. . .	·437	Broke.	
3224	. . .	Broke.		
Breaki'g weight, lbs.	3028	3224	3112	2972
Deflection with nine-tenths of breaking weight, inches,	·435	·402	·397	·371

GIRDER No. 4.

	Exp. No. 1.	Exp. No. 2.	Exp. No. 3.	Exp. No. 4.
	inches.	inches.	inches.	inches.
Total depth, . .	3·99	4·00	3·99	4·01
Depth between upper and lower ribs, .	2·00	2·03	2·05	2·04
Area of top rib, .	1·00	·97	·98	·98
" bottom " .	1·00	·99	·98	1·01
Weight applied, lbs.	Deflection.	Deflection.	Deflection.	Deflection.
40	·002	·002	·002	·003
712	·047	·040	·048	·058
1516	·104	·097	·102	·108
1964	·134	—	—	—
2188	·161	·155	·155	·148
2636	·199	·197	·185	·183
3084	·227	·227	·223	·218
3420	—	·259	—	—
3532	·269	·267	·255	·253
3756	·299	·282	·285	—
3980	·317	·312	·300	·303
4092	·329	·320	·307	—
4148	·336	·322	·313	—
4204	Broke.	·327	Broke.	—
4260	. . .	Broke.	. . .	·333
4316	. . .	. . .	. . .	—
4400	. . .	. . .	. . .	·343
4428	. . .	. . .	. . .	—
4745	. . .	. . .	. . .	Broke.
Break'ng weight, lbs.	4204	4620	4204	4745
Deflection with nine-tenths of breaking weight, inches, . .	·297	·293	·282	·331

GIRDER No. 5.

	Exp. No. 1.	Exp. No. 2.	Exp. No. 3.	Exp. No. 4.
Total depth, ...	ins. 4·02	ins. 4·05	ins. 4·05	ins. 4·04
Depth between upper and lower ribs, . . .	1·04	1·04	1·04	1·00
Area of top rib, . . .	1·125	1·16	1·14	1·22
Area of bottom rib, .	1·162	1·13	1·15	1·20
Weight applied, lbs.	Deflection.	Deflection.	Deflection.	Deflection.
712	Deflections uncertain from imperfect fastening of the cord.	—	—	—
1516		—	—	—
2188		—	—	—
2290		·133	·148	·138
2636		—	—	—
2885		·173	·182	·178
3084		—	—	—
3445		·213	·221	·223
3532		—	—	—
3980		—	—	—
4005		·268	·270	·259
4428		—	—	—
4565		·313	·320	·308
4652		—	—	—
4705		·323	·335	—
4845		·348	·350	·335
4876		—	—	—
4927		—	—	—
4985		·348	Broke.	·340
5008		—	—	—
5050	Broke.	—	—	—
5125	—	Broke.	—	·355
5265	—	—	—	·365
5405	—	—	—	Broke.
Breaking weight lbs.	—	5125	4985	5405
Deflection with 9-10ths of breaking weight, inches,	—	·321	·313	·331

GIRDER No. 6.

	Exp. No. 1.	Exp. No. 2.	Exp. No. 3.	Exp. No. 4.
Total depth, ...	ins. 4·02	ins. 4·05	ins. 4·03	ins. 4·06
Depth between upper and lower ribs, . .	2·52	2·55	2·56	2·61
Area of top rib, . .	1·13	1·18	1·08	1·10
Area of bottom rib,	1·13	1·09	1·11	1·10
Weight applied, lbs.	Deflection.	Deflection.	Deflection.	Deflection.
712	Deflections uncertain from the same cause as Experiment 1, No. 5.	. .	. .	. .
1516		. .	. .	. .
2188		. .	. .	. .
2290		·130	·138	·138
2636		. .	. .	. .
2885		·168	·186	·175
3084		. .	. .	. .
3445		·205	·220	·222
3532		. .	. .	. .
3980		. .	. .	. .
4005		·251	·263	·272
4428		. .	. .	. .
4565		·300	·313	·313
4652		. .	. .	. .
4845		·315	Broke.	·350
4876		. .	. .	. .
4988		. .	. .	·365
5180		. .	. .	. .
5125	. . . .	Broke.	. .	·378
5212	Broke.	. .	. .	. .
5265	. . . .	. .	. .	·382
5405	. . . .	. .	. .	Broke.
Break'g weight, lbs.	. . . .	5125	4845	5405
Deflection with 9-10 break'g weight, ins.	. . . .	·298	·293	·340

GIRDER No. 7.

	Exp. No. 1.	Exp. No. 2.	Exp. No. 3.	Exp. No. 4.
Total depth, ...	ins. 4·05	ins. 4·10	ins. 4·08 . .	ins. 4·05
Depth between upper and lower ribs, .	2·50	2·51	2·51	2·52
Area of top rib, . .	1·19	1·26	1·21	1·16
Area of bottom rib,	1·19	1·19	1·17	1·16
Weight applied, lbs.	Deflection.	Deflection.	Deflection.	Deflection.
2290	·105	·105	·095	·090
2885	·115	·130	·120	·125
3445	·150	·160	·140	·160
4005	·185	·185	·180	·182
4565	·217	·215	·215	·210
5125	·255	·250	·235	·237
5405	·272	·267	. .	. .
5685	Broke.	·285	·270	·272
5825	. .	·292	. .	Broke.
5965	. .	·305	Broke.	. .
6105	. .	·310	. .	. .
6245	. .	·320	. .	. .
6385	. .	·330	. .	. .
6525	. .	Broke.	. .	. .
Break'g weight, lbs.	5685	6525	5965	5825
Deflection with 9-10 break'g weight, ins.	·252	·297	·253	·246

Summary of the Experiments on Transverse Strength, giving the mean results.

	Depth.	Sectional area.	Distance between the ribs.	Breaking weight.	Deflection with nine-tenths of breaking weight.
	inches.	sq. ins.	inches.	lbs.	inch.
Form of beam No. 1 . . .	2·015	1·965	—	1664	·643
	2·020	1·980	—	1888	·667
	2·073	2·135	—	2084	·699
	2·040	2·020	—	1916	·670
Mean	2·012	2·025	—	1888	·670
Form of beam No. 2 . . .	2·54	2·01	·56	2188	·489
	2·53	2·00	·55	2748	·532
	2·49	1·96	·51	2412	·482
	2·50	1·95	·55	2524	·516
Mean	2·51	1·98	·54	2468	·510
Form of beam No. 3 . . .	3·02	2·02	·98	3028	·435
	3·00	2-00	1·00	3224	·402
	3·00	1·98	1·01	3112	·397
	3·00	1·98	1·01	2972	·371
Mean	3·01	2·00	1·00	3084	·401
Form of beam No. 4. - - -	3·99	2·00	2·00	4204	·297
	4·00	1·96	2·03	4260	·293
	3·99	1·96	2·05	4204	·282
	4·01	1·99	2·04	4745	·331
Mean - - - -	4·00	1·98	2·03	4353	·301
Form of beam No. 5. - -	4·02	2·287	1·04	5050	—
	4·05	2·290	1·04	5125	·321
	4·05	2·290	1·04	4985	·313
	4·04	2·420	1·00	5405	·331
Mean - - - -	4·04	2·322	1·03	5141	·322
Form of beam No. 6. - -	4·02	2·26	2·52	5212	—
	4·05	2·27	2·55	5125	·298
	4·03	2·19	2·56	4845	·293
	4·06	2·20	2·61	5405	·340
Mean - - - -	4·04	2·23	2·56	5147	·310
Form of beam No. 7. - -	4·05	2·38	2·50	5685	·252
	4·10	2·45	2·51	6525	·297
	4·08	2·38	2·51	5965	·253
	4·05	2·32	2·52	5825	·246
Mean - - - -	4·07	2·38	2·51	6000	262·

Experiments on Direct Tension.

No. of Experiment.	Sectional area at the place of fracture.	Last weight supported.	Weight with which the bar broke.	Remarks.
	inches.	lbs.	lbs.	
1	1·0506	18,560	18,840	A small air-bubble.
2	1·0557	19,680	19,960	" "
3	1·0100	21,360	21,580	" " at corner very small.
4	1·0364	16,320	16,320	Honey-combed.
5	1·0301	17,440	17,440	Sound.
6	1·0403	16,320	17,440	A small air-bubble.
7	1·0150	21,640	21,920	Sound.
8	1·0200	22,200	22,470	"
Mean,	1·0323	19,190	19,486	

Mean greatest weight supported, per inch,	.	18,590 lbs.
Mean weight which broke the bar, per inch,		18,876 lbs.

Considering the actual breaking weight to be between these two, and rather nearer the latter, when due allowance is made for the small air-bubbles, the mean breaking weight may be taken at 18,750 lbs. per square inch.

*On the Junction of the Atlantic and Pacific Oceans, and the Practicability of a Ship Canal, without Locks, by the Valley of the Atrato.** By Mr. F. M. Kelley, U. S. (America.)

[Abstract of paper read at the Institution of Civil Engineers, April 22, 1856.]

It was stated that the consideration of this subject had become urgent, and the adoption of some definite plan indispensable, in consequence of the commercial activity, which had resulted from the discovery of gold in California, and in Australia, and the rapid development of trade, throughout the whole of the Pacific. But the very extension of trade had introduced new elements into the problem: the larger dimensions now given to ships, and the increasing value of time, rendered it necessary that the proposed communication should be of a sufficient width and depth, to permit the passage of the largest class of vessels, and that it should, if possible, be constructed without locks, so as to insure economy of time, as well as of distance. It then gave a brief review of the different routes hitherto proposed, and the objections to which they were open.

The Tehuantepec route would require 150 locks; even then it would be 210 miles in length, and great improvements would be necessary in the harbors at both ends. The very unsettled state of the government in Mexico, rendered this undertaking most hazardous at the present time.

The Honduras route, 160 miles in length, was open to the same objection as to locks; the summit level was very high, 2681 feet above the sea ; and, moreover, sufficient water could not be obtained, for the number of locks required.

The Nicaragua route, 194 miles in length, would have twenty-eight locks ; the river San Juan would require to be deepened throughout ; 47 miles of additional canal must be made ; great improvements must be effected in the harbor of Greytown, and a new harbor altogether constructed on the Pacific. The modification of this project, by which the port of Realeja, would be the terminus on the Pacific, would increase the distance above 100 miles, and require great additional lockage, which it was very doubtful, whether the Lake Leon could supply.

The Chiriqui route was considered utterly impracticable, by M. Hellert, who found that the supposed passage through the mountains, offered the most formidable difficulties.

The Panama route would require thirty-six locks and six aqueducts, and the approaches on either side, would demand vast alterations to adapt them to the present wants of commerce.

The San Blas, or Mandingo Bay route, had never been sufficiently explored, on account of the decided hostilities of the Indians; moreover, that part of the Atlantic was beset with reefs and shoals, and there was every reason for believing that there was no depression in the mountain range.

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* From the Lond. Artizan, June, 1856.

The Darien route was only partially explored by Mr. Lionel Gisborne, who reported favorably of its capabilities; but subsequent expeditions had invalidated these conclusions, and tended to demonstrate that the Sierras Lloranas, formed an unbroken chain from the Gulf of San Blas to the Gulf of Darien. All explorers agreed on the decided hostility of the Indians, and, with the exception of Dr. Cullen, who averred that he had repeatedly crossed the Isthmus at that point, no subsequent explorer had succeeded in traversing it. It was proposed to construct a canal, without locks; but the great difference in the height of the tide at the two extremities (25 to 30 ft. in the Pacific, and only 2 ft. in the Atlantic), would produce a tidal current of such force as to endanger the works, and materially interfere with navigation.

The Atrato route had already been pointed out by Humboldt, as likely to afford one of the best solutions of the problem. It was stated that the River Atrato flowed almost due north for a length of 300 miles, in the midst of a vast alluvial plain between two ranges, resulting from the bifurcation of the Andes; it then discharged itself by nine mouths into the Atlantic, by the Bay of Candelaria in the Gulf of Darien. The upper part of the river had been carefully explored by Messrs. Trautwine and Lane, who had both reported against the feasibility of any plan for uniting the head waters of the Atrato, with those of the San Juan, which flowed into the Pacific. An exploration on the Pacific side, led to the discovery of a depression in the mountain chain, between Punto Ardita and Punto Marzo, which was found to correspond in an almost direct line eastward with the Truando, one of the most considerable western affluents of the Atrato.

The route more especially advocated in the paper, would commence on the Atlantic side, at the estuary of the Atrato, by widening and deepening one of its entrances, removing the sand bars, and stopping up, by breakwaters and dams, the remaining mouths, so as to direct the full force of the current, into the branch called Caño Coquito, or an entrance might be effected by a side cut from the bay into one of the mouths, and the erection of guard gates at each end; by stopping the current, would prevent any deposit or bar outside. At the distance of two miles from the mouth of the river deepened to 30 ft.: and from this point to the mouth of the Truando, was no where less than 47 ft., with an average width of 350 yards. It was then proposed to follow the Truando for 36 miles, deepening and widening its channel where required, to a point named Townsend's Junction. Up to this point the works required, would be very simple, as the banks were principally levels, formed of sedimentary deposit, and the soil of the bed of the river was of the same character. From Townsend's Junction an open cut was contemplated, for a distance of 13 miles. It was then proposed to tunnel through the base of the ridge, a length of $3\frac{1}{4}$ miles. A double tunnel was recommended, as the width (200 ft.) would require a single arch of too great a height; the division into two arches would also have the advantage of precluding any possibility of collision. The height proposed (120 ft.) would be sufficient to allow of the passage of the largest vessels, by merely lowering their topmast. From the tunnel of the Pacific, a distance of 8 miles, the canal would follow the valley of a small stream, and debouch into Kelley's Inlet.

The line would thus uninterruptedly proceed, without locks, direct south, from the Bay of Candelaria to the junction of the Atrato, 7° 15′ N. Lat. and 77° 8′ 32″ W. Long.—a distance of 67 miles, 1436 yards, whence it would diverge by the Truando to the south-west, and terminate at the Peninsular of Paracuchichi or Kelley's Inlet, 6° 57′ 32″ N. Lat. 78° W. Long.—a distance of 63 miles, 1216 yards. It would thus have a total length of 131 miles, 892 yards, with a minimum width and depth throughout of 200 ft. and 30 ft. respectively. The most important point to be considered, was the rate and direction of the flow of water from the junction of the Truando with the Atrato, and the supply which might be depended on at that point. It had been ascertained by Colonel Totten, the Engineer of the Panama Railway, that the mean level of the two oceans was very nearly, if not entirely, similar. The difference in the height of the tides at the two extremities of the proposed route, was found to be,—at the entrance of the new river in the Pacific 12 ft. 6 in. at spring tides, and 10 ft. 11 in. at neap tides,—while the tidal wave of the Atlantic, at the mouth of the Atrato, never exceeded 2 ft. at any phase of the moon. After careful observation, Captain Kennish had fixed the height of the junction at 15·2 ft. above the mean tidal level of the two oceans.

The junction of the Truando with the Atrato, would thus be 9 ft. above the Pacific at the highest tide, and would flow down it with a velocity equal to that head; while, at the lowest tide, the velocity would be equal to a head of 21·45 ft. The summit being at the same height from the mean level of either ocean, and the distance being nearly equal, their average rate of current would be nearly the same,—about 2½ miles per hour. As far as theory could elucidate the tidal influence of the Pacific, it would extend to Townsend's Junction, and pass under the fresh water coming down the river, without commotion, either at flood or ebb. That part of the river between Townsend's Junction and the Pacific, would be slightly agitated by the rise and fall of the tide, but the velocity of the current would be scarcely affected.

By careful calculation it had been ascertained, that the discharge of the Atrato was 667,014,600 cubic ft. per hour, and the mean discharge of the new river would be about 42,000,000 cubic ft. Now, if this were taken solely from the bed of the Atrato, it would only reduce that river one-sixteenth, and its surface level 3¾ ft., the Atrato being 58 ft. deep at the point of junction with the Truando.

The principal advantages which gave the proposed route the preeminence over all others, were claimed to be:—

1st. That the two oceans could be thus united, by an open channel without locks or any other impediment.

2d. That the width and depth would be sufficient to allow of the simultaneous passage, up and down, at all times, of the largest class of vessels.

3d. That excellent harbors existed at both ends, requiring but little improvement, and at all times perfectly accessible.

4th. That the route passed through a country in undisputed possession of a legal government, and among a people favorable, instead of hostile to the undertaking.

A summary of the estimated cost of the canal, including the works of every kind throughout its whole length, with lighthouses, piers, depôts, &c., as also the execution, medical and commissary departments, was annexed to the paper. The total, including all contingencies, was fixed at 145,407,042 dollars, or £30,000,000. In constructing the canal of a width sufficient for the passage of one ship at a time, the estimate would be reduced nearly one half.

The vast saving in time and distance, which would be effected by this canal, was then dwelt upon. From New York to San Francisco, it would be no less than 13,000 miles, and proportionately large for all the ports in the Pacific. Details were given of the rapid development of trade which was annually increasing between great Great Britain, France, and the United States—and the Pacific; and also an approximate calculation of the commercial value of the canal.

In conclusion the author repeated, that the plan developed was, perhaps, not the only practicable one,—that although the information contained in the paper had been obtained, by sending to the Isthmus four different corps of engineers, fully provided with instruments for leveling and surveying, and they had made complete plans, and sections of the route, yet that a more extended survey might suggest the superiority of selecting some other affluent of the Atrato, and some other terminus on the Pacific. His principal object had been to show, the practicability of communication between the two oceans, by the valley of the Atrato, and that it possessed peculiar advantages for rendering that communication as large and open as the present wants of commerce imperatively required. If such was the case, he thought that it was worthy of an official survey, and thorough examination, by the Governments of the great commercial nations of the world.

April 29, 1856. The entire evening was devoted to the discussion upon Mr. F. M. Kelley's paper.

It was admitted that a correct description had been given of the routes hitherto proposed, and of the valley in question; but that the route by Panama would be found the most economical and most convenient, if the communication was made between the River Chagres and the Rio Grande, where there were only 15 or 16 miles from tide to tide, instead of by Chorrera, as proposed by M. Napoléon Garrella.

It was objected that Mr. Trautwine, when starting on his expedition, was not supplied with proper instruments for taking a correct survey, and, therefore, that his account could not be implicitly relied on;—that Captain Kennish, on his return to Carthagena, was also in possession of but imperfect levels, and that if the height of the junction of the Truando with the Atrato, was not absolutely correct, it would invalidate all the calculations of the work to be performed. But even assuming the figures and levels of the author, it would hardly be possible to execute works of such gigantic proportions without a great sacrifice of life. It was true that Chagres and Greytown were the two most unhealthy places in Central America (and, perhaps, even in the world, 400 out of 600 of the Irish workmen employed on the Panama Railway having died in three years, and H. M. S. *Rosamond* having lost more men in six months, off Greytown, than during a three years' station on the West Coast of Africa); but the valley of the Atrato was also very unhealthy, as was evidenced by the state in which Captain Kennish returned, after his exploration. If the necessity for a tunnel was granted, then other places might be found more advantageous for inter-oceanic communication, and Darien presented greater facilities.

Another objection to the proposed route, was the great length of the canal, entailing the employment of steam tugs, which would be found more expensive than trans-shipment by the Panama Railroad. Particulars were given of the height of the range of mountains running through Central America, more especially opposite Port Escosces: the summit level was stated to vary between 950 and 1150 ft., and the apex of the ridge, or backbone. of the Andes, to be so narrow as not to allow of more than five men walking abreast, even supposing it to be cleared of trees. But the chain of the Andes had not been sufficiently examined, to ascertain whether or not it was unbroken between the Napipi, where the depression was found to be 300 or 400 ft., and the Panama Railroad, of which the summit level was only 250 feet. This was a most desirable point to be assured of, before coming to any determination upon the best route; and it was also of great importance that the coast on both sides should be accurately surveyed, to fix upon good harbors, for it was next to impossible to create them; the maps and charts at present in use were not to be relied on. It was doubted, also, whether the traffic would ever repay the cost, for the route from England to Calcutta, or Hong Kong, was actually 600 miles longer by Panama, than by Cape Horn; although it was, of course, admitted, that the former route had the advantage of calmer seas, and of the absence of wind, and that this was no argument against the American trade justifying such an expenditure.

The results of observations with the mountain barometer, were also given, showing that its variations constituted a regular tide, by a knowledge of which calculations could be based with sufficient accuracy, for preliminary surveys, as they would never vary more than 10 ft. from those obtained by sections run with instruments.

It was contended on the other hand, that Mr. Trautwine, Mr. Lane, Mr. Porter, and Captain Kennish, had all been furnished with proper instruments, and that the spirit level had been used for the survey of the whole length of the Atrato, and from the Pacific on the west, over the summit of the Andes, down to the river Truando on the eastern side,—that Captain Kennish was thoroughly qualified for the task he had undertaken; and that the five different surveys, which had been undertaken at different times, and by different persons, all agreed in their results. It was admitted that the whole of Central America was very unhealthy; but it was stated that the proposed route was less so than the Isthmus proper. It was submitted that these were not the questions at issue, but whether a practicable route could be made between the two oceans by the valley of the Atrato, and whether sufficient evidence had been shown to authorize an official survey.

A letter was read, addressed by Baron Von Humboldt, to Mr. Kelley, (after examining the maps and plans,) expressing great confidence in the survey made and levels taken by Mr. Kennish, and his predecessors. The large number of maps and sections taken on so large a scale furnished all the elements necessary for forming an opinion of a possibility of a communication through the mouths of the Atrato, by the Truando, and by a canal to the Pacific. The failure of the expedition in 1852, and subsequently, for exploring the mountainous country between the Gulf of San Miguel and Caledonia Bay, might be ascribed to the want of such plans.

Humboldt expressed an opinion that a free and open discussion would demonstrate the relative advantages and disadvantages of each proposed locality, and there would really be little difficulty in tracing the proper route, wherever there were good plans and sections, such as had been made under Mr. Kelley's directions, of the valley of the Atrato; his opinion in favor of that route, as compared with all the others, had always been strongly expressed; and in his works, he had even given all the details he had collected relative to the small canal stated to have been made in the year 1778 by the Indians, under the direction of a monk, the Curé of Novita, in order to unite the waters of the river Raspadura with those of the river San Juan, and thus establish a water communication for canoes across the Isthmus. He alluded also to the labors of Captain Fitzroy, R. N., who had in his report, on the Isthmus of Central America, descanted on all the known routes; and he recalled the statement of Lieutenant Wood, R. N., when surveying the coast, to the effect that he traveled on foot, with native guides, from Cupica to the Napipi, in which he bathed, and returned to his ship within six hours, and that the most elevated ground passed over, did not exceed 300 or 400 feet. In fact, Humboldt looked upon the proposition of forming an inter-oceanic canal, by the valley of the Atrato, as perfectly feasible; and he even added, " without locks, or, if possible, without tunnels."

It was due to Mr. Kelley to state, that he did not appear as the agent of any other persons; but that he had caused these various surveys to be made solely at his own cost, and that he had already expended large sums, for the prosecution of these investigations which were carried on under his direct suggestions. In further explanation of Mr. Kelley's views, it was stated that originally he had been favorable to the route by the Atrato and the Raspadura, but subsequently, he became convinced that the route by the river Truando, to Humboldt Bay, would be preferable. He had, therefore, instructed Mr. Kennish and Mr. Lane, to survey that part of the country, and the result had been that the latter route was the one that he at present recommended. He was, however, by no means, prejudiced in favor of any one particular route. His anxiety was, that very accurate and extensive surveys of these districts should be made, under the auspices of the Governments of Great Britain, France, and the United States; and he believed that part of the Isthmus would be found to present more favorable features than any other. With regard to the river Atrato, it was mentioned that it was only to be compared in magnitude with the largest of the American rivers, and was known to be navigable for the largest ships as far as beyond the junction with the Napipi. It would, therefore, not require any change below that point, and the nature of the climate was such as to preclude the probability of the supply of water failing at any season. It also drained the whole valley, in which rain fell for nine or ten months in the year; besides which, it received a number of rivers, some of which were of equal size with those of the Truando, the current of which it was proposed to reverse, so as to turn the water of the upper part of the Atrato, into the channel of the Truando, and thence into the Pacific.

Although the mean level of the two oceans was generally agreed to be the same, yet in the northern and narrowest parts of the Bay of Panama the tide rose 20 or 30 ft., whilst at Humboldt Bay, to the south, it did not rise more than 12 ft. The high tide level at this latter point, was, therefore, nearly on a level with the junction of the Truando and the Atrato—so that the current would not be so great as to prevent navigation or to damage the works in the channel, as it had been contended would be the case, if a canal were made across the narrow part of the Isthmus where the lift of the tide was greater.

In concluding the discussion, it was stated that the Institution was very much indebted to Mr. Kelley for the paper he had brought forward. It gave a clearer insight than any of its predecessors, into the difficulties of the whole problem of an inter-oceanic canal, and it suggested a route which possessed greater facilities than any other that had been proposed. The English, French, and United States' Governments, entertained enlightened and enlarged views on the subject, and it was believed, that at the proper moment they would lend their strenuous aid in furtherance of this great question, so important to the commercial and political interest of the world.

AMERICAN PATENTS.

List of American Patents which issued from June 3d, to June 24th, 1856, (*inclusive,*) *with Exemplifications.*

JUNE 3.

1. For an *Improvement in Uterine Supporters;* William Alley, Columbus, Georgia.

Claim.—"The circular rings, perpendicular springs, and the hinges to the rings."

2. For an *Improvement in Gas Burning Lamps;* Solomon Andrews, Perth Amboy, New Jersey.

Claim.—"The wick tube, surrounded by an outer tube or cylinder."

3. For an *Improvement in Marble Sawing Machines;* Josiah Ashenfelder, Philadelphia, Pennsylvania.

Claim.—"Operating the saws by means of pins and shaft, attached to the drums, in combination with connecting rods and slotted guide bars."

4. For an *Improvement in Feeding Apparatus for Gas Retorts;* N. Aubin, Albany, New York.

Claim.—"The vessel to contain the materials from which the gas is to be made, in combination with the inner vessel or weight, arranged so as to gradually expel the contents of the vessel as they are melted or rendered more fluid by the heat of the retort, and thereby afford a regular supply of said materials, to the gas-making process going on in the retort."

5. For an *Improved Method of Regulating Wind Mills;* Jesse Battey, Honeoye Falls, New York.

Claim.—"The regulator, either with a perpendicular or inclined wing, or with the shaft standing upright, and the wing turning horizontally, and its combination with the regulator. Also, the rotary vane and its arrangement, and the connexion of the combined regulators, or either of them separately therewith, for the purpose of securing uniformity of speed. And, lastly, the entire arrangement for starting and stopping the mill."

6. For an *Improved Piano-Forte Action;* Joseph Becker, City of New York.

Claim.—"The double broken action—the part or parts being combined and acting together, completing the whole arrangement of the double broken arrangement."

7. For an *Improvement in Relieving Side-Valves from the Pressure of Steam;* Wm. Burdon, Brooklyn, New York.

Claim.—"The employment of a hollow cylinder, with a closed head, supported upon wheels to run back and forth on the valve seat, or on ways parallel thereto, and receiving a piston attached rigidly to the valve, and thereby being caused to travel with the valve and relieve it of all pressure of steam, beyond what is necessary to confine the valve to its seat."

8. For an *Improvement in Window Frames;* John Casey, City of New York.

Claim.—"Having the portion of one of the stiles of the casing provided with curved slots at its upper and lower ends, and having lugs which are attached to the stile fit in the slots, whereby the part or portion is rendered adjustable."

9. For an *Improvement in Nut Machines;* Richard H. Cole, St. Louis, Missouri.

Claim.—"The arrangement of the round, within an aperture in the angular punch, at the same time that a round punch is arranged within an aperture in the bottom of the nut-box, when the said round punches are combined with movements which cause them to act jointly in perforating holes in the nuts formed in said nut-box. Also, the arrangement of the angular punch and its interior round punch, with the bottom of the nut-box, and the interior round punch; when the said bottom of the nut-box is combined with a spring or its equivalents, in such a manner in relation to the said angular punch, and the round punches, that the action of the said parts in forming a nut, will cause the completed nut to be thicker than the bar from which the blank was cut."

10. For an *Improved Device and Walls of Buildings for Preventing Damage to Goods in case of Fires;* Thomas Estlack, Philadelphia, Pennsylvania.

Claim.—"The combination of the receiver in the masonry of the wall, with the chute, extending over and into the receiver, secured to the floor to be relieved, and altogether detached from the aforesaid receiver."

11. For an *Improved Machine for Polishing Metallic Nuts;* Richard H. and John C. Cole, St. Louis, Missouri.

Claim.—"The arrangement of the planing wheel, the nut-carrying endless-chain, with the partially inclined and partly horizontal groove—the sustaining plates and the edge guiding plates."

12. For an *Improvement in Rotary Brick Machines;* George Crangle, Philadelphia, Pennsylvania.

Claim.—"The apparatus for rotating and stopping the cylinders of rotary brick machines; the said apparatus consisting of the armed disk, the branched lever, the bent lever pawl, and the rachet wheels."

13. For an *Improvement in Needles for Knitting Machines;* Rufus Ellis, Boston, Mass.

Claim.—"Making the journals or connecting rod of the hinge, fast to the male or entering projection thereof, in combination with so constructing the female socket of the hinge, as to enable the male part or its journals, to be moved downwards and laterally, in order to detach the same from the female part, with a spring stop or its equivalent, whereby, when the male and female parts of the hinge of two links are connected together, they may be prevented from accidental disengagement."

14. For an *Improved Saw-Set;* Benjamin Gilpatrick, Lowell, Mass.

Claim.—"The pedestal, the screw attached thereto, and the check-nut and truncated cone or their mechanical equivalents."

15. For an *Improvement in Machines for Felting Hat Bodies;* Sylvester H. Gray, Bridgeport, Connecticut.

Claim.—"The manner in which the compound, continuous, and vibratory motion is imparted to the endless bed."

16. For an *Improvement in Gas Consuming Furnaces;* Jacob Green, Philadelphia, Pennsylvania.

Claim.—"The mode of regulating the admission of air to furnaces, so that each admission shall be controlled by the furnace itself, by means of lever and valve, in connexion with the rod and valve."

17. For an *Improvement in the arrangement of a Gas Retort Bench;* John G. Hock, Newark, New Jersey.

Claim.—"The arrangement of the flues, by which the flame and heated products of combustion are caused to pass, first, under the bottom retorts; next, under the top retort; then, under the retorts, and finally over."

18. For a *Copying Press;* Christian Knauer, Pittsburgh, Pennsylvania.

Claim.—"Adjusting the plates of a copying press to suit the different sized books, by means of a regulating cam, which carries the top plate—so arranged that it shall be the bearing of the pressure cam—either directly or by the intervention of the piston piece."

19. For an *Improved Sawing Machine;* Wm. D. Lavitt, Cincinnati, Ohio.

Claim.—"The arrangement of devices, when combined with the mechanism for setting the saw forward in its own plane."

20. For an *Improvement in Harvester Frames;* Henry F. Mann, Westville, Indiana.

Claim.—"Inclining the rear portions of the side pieces, so that the shaft may lie upon and have the same dip with the one on which it is supported, for the double purpose of giving said shaft a firm support, and to bring its drive-wheel close down to the pinion on the crank shaft."

21. For an *Improvement in Melodeons;* Wm. H. Manning, Rockport, Mass.

Claim.—"The reed box, with the perpendicular valves."

22. For an *Improved Marble Sawing Machine;* Robert Myers, Factory Point, Vt.

Claim.—"The arrangement of the shafts, relative to the driving shaft and to each other, in combination with the saws and varying pitmans, for effecting the simultaneous cutting of three or more taper blocks, at a single operation."

23. For an *Improvement in Wool Carding Machines;* Foster Nowell, Lowell, Mass.

Claim.—"The use, in carding machines, of two surfaces, for conducting and rubbing the sliver from the ring doffers—one of which is cylindrical, and of permanent form; and the other, a belt or apron of flexible material, and capable of adjusting itself to the shape of the cylindrical rubber and the sliver or roving between itself and the cylindrical rubber."

24. For an *Improvement in Making Nuts;* Richard H. Cole, St. Louis, Missouri.

Claim.—"Forcing a portion or the whole of the metal, displaced in forming the holes in the nuts, into the bodies of the nuts; by which I am enabled to make the nuts thicker and more compact than the bar from which they are cut."

25. For an *Improvement in Glass Furnaces;* Samuel Richards, Philadelphia, Penna.

Claim.—"1st, The preparatory deposit of the batch in the cone of an ordinary glass furnace, for utilizing the waste heat. 2d, The car, arranged and used in combination with side shelves. 3d, The movable spout, for conveying the heated batch from the heating shelves into the crucibles."

26. For an *Improvement in Melodeons;* Josiah A. Rollins, Buffalo, New York.

Claim.—"1st, The extension of the wind receiver, towards the back and front of the case, by forming cavities between the frame and the tube board; thereby obtaining room under the tube board, for the operation of two sets of valves—one behind the other—to operate on four sets of reeds, without increasing the usual size of the case. 2d, The arrangement of the two sets of valves, to bring their movable ends together, and the fitting of the two ends together, so that by the depression of the valves of one set to open them, the corresponding valves of the other set are depressed and opened—thereby effecting the opening of the two sets of valves, by a single set of push-down pins and the keys of ordinary construction. 3d, Supporting the front set of valves at their hinges, by a strip of wood or other material."

27. For an *Improvement in Sewing Machines for Binding Hats;* Isaac M. Singer, City of New York.

Claim.—"The method of turning the hat by the action of the spring or its equivalent, in combination with the feed-motion acting on the rim. and the gauge, against which the edge of the rim bears. Also, the mode of regulating the tension of the binding and smoothing out the plaits and kinks, by passing it around the several folds of a spring."

28. For an *Improvement in Elastic Bottoms for Chairs and other articles;* Lysander Spooner, Boston, Massachusetts.

Claim.—"In the construction of an elastic rest or support, I claim the employment of a series of elastic coils."

29. For an *Improved Boring Machine;* William Samuels and George L. Stansbury, Jackson, Indiana.

Claim.—"The power boring machine."

30. For an *Improvement in Cooking Stoves;* William B. Treadwell, Albany, N. Y.

Claim.—"Connecting the flue in front of the oven with the exit pipe, by means of a tubular flue or flues at top, and forming part of the top of the oven, in combination with the plate which forms the residue of the top of the oven."

31. For an *Improved Marble Sawing Machine;* John A. Toll, Sugar Ridge, Ohio.

Claim.—"The combination of saw gates, adjustable fenders and pair of actuating rollers, having simultaneous vibration, the rollers being secured in bearings in the top of the rockers, so as to permit of being easily removed when it is desired to take out or replace a gate."

32. For an *Improvement in Operating Valves for Steam Engines;* Otis Tufts, Boston, Massachusetts.

Claim.—"1st, The oscillating plate with its attachments, carrying the adjustable cut-off cams acting with their sliding rolls for cutting off the steam variably. 2d, The self-adjusting arrester, and its parts acting on the closing edge of the adjustable cut-off cam, for easing off the motion of the cut-off valve and its gear. 3d, The adjustable arrangement in combination of the cut-off and exhaust cams, to work the cut-off and exhaust valves united. 4th, The double arm, with its sliding and other roll acting alternately on the cut-off and exhaust cams. 5th, The gear joint connexion, between the regulator shaft and the adjusting screw, for working them together, while one is fixed and the other oscillates. 6th, The sliding carrier, with its attachments and friction held nut, for adjusting the variable cut-off cams on the oscillating plate by the regulator. 7th, The arrangement of the adjustable coil springs, in combination with their shaft and lever for forcing the rolls to the cams."

33. For an *Improved Sawing Machine;* Henry S. Vrooman, Logansport, Indiana.

Claim.—"1st, The combination of the frame and sashes when connected and arranged as shown, so that the sashes and frame may be turned within or upon the frames, and thereby allow the saws to be operated in oblique positions. 2d, The employment or use of two patterns, when said patterns are so arranged or connected with the frames and saw sashes, that one pattern will give the saw its lateral movement, and also turn the saw in the sashes, so that their teeth will face the intended direction of the cubs or kerfs, while the other pattern will move the saw when necessary, more or less obliquely, to give the winding or beveled side to the work or stuff."

34. For an *Improved Filter;* Chapman Warner, Green Point, New York.

Claim.—"1st, Constructing the cistern, vessel, or reservoir, with an inner well or vessel, the lower part of which projects below the bottom of the cistern or vessel, and is provided with any other proper filtering material ; the lower part of the vessel, by a tube, provided with a gate or valve, and a suction tube, also communicating with the lower part of the well or vessel. 2d, The flanch, attached to the inner side of the well or vessel, between the layers of charcoal and sand."

35. For an *Improvement in Gas Regulators;* Marshall Wheeler, Honesdale, Penna.

Claim.—"The combination of the gasometer and its goose neck, with the fluid receptacle, and with the graduated lever, and the weighing poise."

36. For an *Improvement in Grain and Grass Harvesters;* Allen B. Wilson, Waterbury, Connecticut.

Claim.—"The elastic strips, fitted in the fingers."

37. For an *Improved Method of Attaching Stem to a Conical Valve;* Henry R. Worthington, Brooklyn, New York.

Claim.—"The use of the hollow conical plug, with the apparatus for opening and closing the same, attached at the bottom of said plug."

38. For an *Improved Lock;* Linus Yale, Jr., Newport, New York.

Claim.—"1st, The peculiar form of the tumbler or an equivalent form, in combination with a changable key. 2d, The rib or wing."

39. For an *Improvement in Fire Arms;* Frederick B. E. Beaumont, Upper Woodhall, Barnsley, England ; patented in England, Feb. 20th, 1855.

Claim.—"When the hammer has a mechanism by which said hammer may be set to cock by a direct pull upon it, and when the trigger, hammer, and rotary series of barrels are so combined, that by a backward pull on the trigger, the hammer shall be elevated, the series of barrels turned, and the hammer set tree or discharged. I claim combining with the hammer and trigger, a mechanism, (viz: the hooks and slot or their mechanical equivalent or equivalents,) whereby the trigger shall be drawn backward, and the series of barrels turned while the hammer is being drawn back by a direct pull on it."

40. For an *Improvement in Washing Machines;* Solon Bishop, Homer, New York.

Claim.—"The use of the yoke in combination with the spindle and uprights, for giving steadiness to the disk."

41. For an *Improvement in Washing Machines;* John T. Bever, Haynesville, Missouri.

Claim.—"The lever, stem and rubber, when used in combination with the arm, cord, and spring, for producing a vertical and partial rotary movement of said rubber."

42. For an *Improvement in Hand Corn Planters;* Samuel L. Denney, Penningtonville, Pennsylvania.

Claim.—"The combination of the planting cylinder, the pistons, and the funnel."

43. For an *Improvement in Elastic Bearings for Railroad Chairs;* David L. Davis, Dedham, Massachusetts.

Claim.—"Covering the india rubber or other elastic substance with the metallic cap, constructed and applied to the chair, so as to be independent of the control of the spikes which secure the chair to the sleeper, that the plate may be left free to vibrate in a vertical direction and independent of the chair."

44. For an *Improved Amalgamator;* James W. Evans, City of New York.

Claim.—"The use of the rake in combination with the rocker, whereby a compound agitating motion is obtained."

45. For an *Improvement in Railroad Car Brakes;* Mahlon S. Frost, Detroit, Mich.

Claim.—"The arrangement of the sliding blocks at the ends of the car platforms, for engaging and operating simultaneously a set of through bumper and traction rods for applying the brakes, the said sliding blocks being under the control of the engineer, and capable of acting upon both sets of rods or either separately as may be desired."

46. For an *Improvement in Self-registering Ships' Compasses;* R. H. Beverly, Chelsea, Massachusetts.

Claim.—"Registering permanently and automatically the ship courses, on a continuous strip of paper or other material, at known or fixed intervals of time, for a part or the whole of a voyage, by means of the continuous clock-feed to the fillet or strips, in combination with the ships' compass and marker."

47. For an *Improvement in Sub-soil Ploughs;* Cyrus Garrett and Thomas Cottman, Cincinnati, Ohio.

Claim.—"The arrangement of the standard, flanch, share and mould board, and these arranged with the brace bar and stay bar."

48. For an *Improvement in Paralactic Instruments for Measuring Distances;* Horace L. Hervey, Quincy, Illinois.

Claim.—"Combining the traversing or sliding telescope with the fixed one, in such a manner as to measure distances, by means of a constant angle between them and a variable base."

49. For an *Improvement in Fire Arms;* George Kesling, Lebanon, Ohio.

Claim.—"The constructing of a gun or fire arm, for firing a succession of shots, thus forming a new article of manufacture, superior to any now in use."

50. For an *Improved Apparatus for Rolling and Handling Barrels, &c.;* Servetus Longley, Cincinnati, Ohio.

Claim.—"The levers, in combination with the spring, chain, and cam attachment, clutches, working freely upon wrists and the handle."

51. For an *Improvement in Washing Machines;* John M'Chesney, Louisville, Ky.

Claim.—"The adjustable suspension of the rubber disk by cords, ratchet and pawl, in combination with the rotary, radial, and fluted frustrums of cones in the rubbing face of said disk."

52. For an *Improvement in Revolving Last Holders;* Josiah Mumford, Clarksburgh, Ohio.

Claim.—"The so arranging of the two arms carrying each a last, to one revolving plate, having two inclined planes upon it, that both arms shall revolve at once, and when the last on one shall be up, the other shall be down, and *vice versa,* for the purpose of bringing one last into convenient position for the operator, and removing the other one entirely out of his way."

53. For an *Improvement in Reaping Machines;* Jacob I. and H. F. Mann, Westville, Indiana.

Claim.—"The combination of the bar or plate H, or of other equivalent device, at the back of the apron, with the strip E beneath the apron, and the bar or plate G upon the finger bar, under which the said strip E, and over which the apron extends, or with other equivalent device."

54. For an *Improvement in Machinery for Raking and Loading Hay;* Joseph Smith, Condit, Ohio.

Claim.—"The spring guard plate, operated by the rake."

55. For an *Improvement in Machines for Husking Corn;* Oren Stoddard, Busti, N. Y.

Claim.—"The two stripping rollers, in combination with the cutting device formed of the gate or frame, with knife attached, and the stationary knife on the platform, the frame being operated, whereby the husks are stripped from the ears, and the ears cut from the stalks. Also, in combination with the stripping rollers and cutting device, the rollers by which the ears are fed or guided into the inclined spout."

56. For an *Improvement in Lattice Bridges;* Lucius E. Truesdell, Warren, Mass.

Claim.—"The braces in combination with the rafters."

57. For *Improved Driving Wheels for Steam Drags or Propellers;* George W. N. Yost, Pittsburgh, Pennsylvania.

Claim.—"1st, The combination of the double angular flanches, with the surface of a driving wheel. 2d, In combination with the flanches, the clearers."

58. For an *Improved Steam Land Propeller;* George W. N. Yost, Pittsburgh, Pa.

Claim.—"The combination and arrangement of a rotary engine, with the driving wheels of a land propeller, by means of the arrangement of cogged gearing."

59. For an *Improved Vise;* Abraham Huffer and Benjamin Fahrney, Washington Co., Maryland.

Claim.—"The use of the sectors, in combination with studs, for the purpose of rendering the jaws of the vise parallel to each other."

60. For an *Improvement in Making Screws;* Cullen Whipple, Assignor to New England Screw Company, Providence, Rhode Island.

Claim.—"The combination of the feeding slot, moving series of discharging grooves, and guard plate."

61. For an *Improved Miter Box;* William P. Wood, Assignor to self, and Samuel De Vaughan, Washington, D. C.

Claim.—"The arms."

62. For an *Improvement in Nail Machines;* Daniel Dodge, Keeseville, New York.

Claim.—"The use of the roller, the anvil, and the hammers, either in combination with the spring or without it."

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63. For an *Improvement in Hand Pegging Machines;* Wm. W. Batchelder, City of New York.

Claim.—"The attachment of the knife to the plunger, and the arrangement of the upper groove in regard to shutting off communication between the trough and the peg receiver. Also, the combination of the vibrating foot piece with the lower end of the machine, operated by means of the wedge and spring."

64. For an *Improved Hydro-Steam Engine;* Wm. Baxter, Newark, New Jersey.

Claim.—"The method of imparting rotary motion to a wheel or wheels, by the pressure of steam or other equivalent, expanding gas acting alternately on the opposite one of two columns of water, or other liquid, connected together to cause the said water, by such alternate action, to pass through and impel the wheel or wheels."

65. For an *Improvement in Harness Trace Couplings;* Charles K. Bradford, Lynn, Massachusetts.

Claim.—"The combination of the india rubber plug or spring friction bearer, with the tenon button and its locking case; the same being made to operate therewith. Also, arranging in the locking case, and transversely of its entering slot, the safety recesses."

66. For an *Improvement in Rotary Pumps;* John Broughton, Chicago, Illinois.

Claim.—"A rotary pump, composed of a rotary eccentric piston, within an oscillating barrel, with any arrangement of inlet and outlet passages."

67. For an *Improvement in Cutting Flour Mill;* Jonathan Burdge, Cincinnati, O.

Claim.—"Forming the surface of the cutter head with central and peripheral ledges, and a plane or level depression between them, equal in width to the cutters, and in depth to the depth of the cut required, for the purpose of easily setting the cutters all to an exact and uniform height, and of preventing the possibility of their being brought into contact with the counter plate above; and, also, for the purpose of preventing the escape of meal or particles of grain at the periphery. Also, the notches or nicks in the ledge of the cutter head, and the notches in the ledge or surface of the counter plate—said notches having the least possible width at their inner ends, and gradually widening or flaring outwards, when the two sets are arranged in combination, so as to cross each other, and thus mutually escape outward by their edges, any dust or glutinous substance, which may have a tendency to adhere to the opposite surfaces of the ledges. Also, the peculiar construction and arrangement of the counter plate, with bent, gathering and stationary ridges, running across from the inner to the outer peripheries of a conical concavity in its under side—the lower edges of said ridges being all in the same plane, and even with the surrounding surface, when combined with the cutters, and operating in combination therewith."

68. For an *Improved Machine for Manufacturing Reed Boards for Melodeons;* Jeremiah Carhart, City of New York.

Claim.—"1st, The means whereby the reciprocating motion, with variable stroke, is communicated to the frame, viz: the segment which gears into the rack on the frame, and into the pinion on the shaft; the pulleys on the shaft, and the shaft in the frame actuated by the bar, and the bars on the frame, by which the pulleys are alternately connected and disconnected with the shaft. 2d, The dogs. 3d, Giving the lateral feed-motion to the frame, by means of the rack and pawl, when said pawl is actuated by the bars and rollers."

69. For an *Improved Method of Operating Head Blocks of Saw Mills;* John M. Carlisle, Williamston Springs, S. C.

Claim.—"Attaching or connecting the carriage to an endless chain or belt, by means of an arm, so that it will actuate at each end of the stroke of the carriage a slide having a pawl attached—which, by means of suitable gearing moves or sets the log to the saw—whereby the movement of the carriage, and also the setting movement of the log, are rendered automatic or self-acting."

70. For *Improved Water Proof Percussion Caps;* James Chattaway, Hamden County, Massachusetts.

Claim.—"The application to percussion caps. of a fusible alloy, which will melt without exploding the powder; using for that purpose the metallic compound, or any other substantially the same."

71. For an *Improvement in Steam Pressure Gauges;* Samuel W. Brown, Lowell, Massachusetts.

Claim.—"The combination of the rigid radial arms, with the flexible and elastic disk or surface, for covering the joints of these radial arms steam-tight—when yielding or moving, by the force of steam or water, to correctly indicate the pressure thereof—the radial arms being fitted so as to operate so close to each other as to prevent the surface from bagging.

72. For an *Improved Shuttle Operator;* Hiram Collin, Salisbury, Mass.

Claim.—"Opening and closing the blind or shutter, by means of the inclined or oblique rod, which passes through the stiles of the casing, and having its lower or outer end bent and fitted within a socket attached to the lower part of the shutter or blind; the rod or blind, being secured at desired points by means of the pin in the knob."

73. For a *Machine for Coating Cloth with Paint;* Daniel Cushing Wheeling, Va.

Claim.—"The arrangement of the several rollers and belts, wherein I make use of the friction of the cloth on the roller, for the purpose of giving the necessary tension and movement of said cloth, when in combination with the means of spreading the paint or composition, and in the delivery of the cloth when coated. Also, the arrangement of the hanging frame, for the purpose of receiving the cloth for drying—thereby rendering the painting and hanging it, a single mechanical operation."

74. For a *Machine for Rubbing and Polishing Painted Cloth;* Daniel Cushing, Wheeling, Virginia.

Claim.—"The mechanism, for the purpose of rubbing painted or enameled cloth."

75. For an *Improvement in Cleaning India Rubber;* Austin G. Day, Seymour, Conn.

Claim.—"The exhaustion of the noxious gases from the crude india rubber, and its subsequent treatment, for the purpose of cleansing and purifying it."

76. For an *Improved Pocket-Book;* J. C. Dickinson and Robert Bate, Hudson, Mich.

Claim.—"The plate, with hooks attached; the plate being secured at one side of the pocket-book, and used with or without the sliding plate."

77. For *Improved Shears for Sheet Metal;* Henry C. Dole, Adrian, Michigan.

Claim.—"The employment of pitman, levers, and eccentric wheels, for operating the blades, in combination with the adjustable gauge."

78. For an *Improved Method for Effecting Uniform Pressure upon the Pumping Piston of Double-acting Steam Pumps;* Robert B. Gorsuch, City of New York.

Claim.—"The secondary piston, in combination with pump cylinder—depending for its action upon the elastic balance chamber, and the reverse motion of the pump plunger combined, or either separately, for attaining the end in view."

79. For an *Improvement in Three-Wheeled Carriages for Children;* John H. Gould, City of New York.

Claim.—" The curved arms, resting upon the arms or bars, forming a support for the body of the carriage, and terminating in sockets, both in front and back, for the reception of the arms of the frame, for the purpose of permitting the carriage to be drawn and pushed from either the back or front position."

80. For an *Improved Tool for Watch-makers;* Wm. Hart, Mayville, Wisconsin.

Claim.—" Having the jaw attached to the upper part of the leg of the callipers and the jaw—connected to the upper part of the leg by links—the jaw having a shank attached to it, the shank passing through a slot in the leg, and bearing against a spring; and the shank having a rod attached to it—which rod passes through a hollow screw which is attached to the jaw—the screw having a nut upon it."

81. For an *Improvement in Thrashing Machines;* Wm. Holmes, Brooklyn, N. Y.

Claim.—" The use of a series of cams, for the purpose of operating the beating levers, by revolving in the curves, and striking both arms of each of the levers in rapid succession, giving to the downward motion of the longer arm or beater, a quick, whipping stroke."

82. For an *Improvement in Feed Apparatus for working Gutta-percha;* James Reynolds, City of New York.

Claim.—" The combination of the rotary forcing apparatus, consisting of a cam for forcing out the sliding pistons, arranged entirely within the rotating head, with a passage or passages within the rotating head, which carries the said pistons, providing for leakage."

83. For an *Improvement in Hermetically Sealing Preserve Cans;* Charles E. Russell, St. Louis, Missouri.

Claim.—" The combination of the spring ring and groove."

84. For an *Improved Method of Applying Horse Power to Fire Engines;* David Russell, Lockport, New York.

Claim.—" The arrangement of the series of pumps, with the circular tram way, and the mechanical devices actuating the pistons."

85. For an *Improvement in Safes for Ships and other Vessels;* Wm. Mount Storm, City of New York.

Claim.—" 1st, The combination of the receptacle or "sheath"—open at the bottom, and at its top open to the upper deck, with the (independently water-tight) double shelled buoy—having within it, the independently water-tight " deposit chamber " for valuables, said chamber being accessible from the exterior by a water-tight door, closing and clamping for that purpose on an elastic seating, &c. 2d, The buoy, the tube, flag, and float."

86. For an *Improved Machine for Sticking Pins;* J. B. Terry, Hartford, Conn.

Claim.—" 1st, The movable conductor or conductors, with notches for the head to hold the pins, and push them into the crimp portion of the paper. 2d, The movable notched cross-bar, to correspond with the notches in the conductors, and the movable plate, or its equivalent, to hold the pins in their proper place, while the pins are thrust to their place by the conductor. 3d, The combination of the movable conductor or conductors, the apparatus for changing the position of the points of the pins, and holding the samewith the clamp or jaws, which hold the paper while the pins are thrust through."

87. For an *Improvement in Constructing Railway Car Wheels;* Wm. R. Thomson, Cleveland, Ohio.

Claim.—" Having the butts made the entire length of the hub, and the sides of the butts inclined—caused or made in zig-zag form—so that they form, when placed together, dove-tail joints, for the purpose of preventing any lateral movement of the butts, and to ensure the perfect welding of the same, at all points of contact, whereby a solid and perfect hub is obtained."

88. For an *Improvement in Registers and Ventilators;* Edward A. Tuttle, Williamsburgh, New York.

Claim.—" The combination of the leaves or valves, and the centre-piece, connected together in working order at the points."

89. For an *Improved Bolt for Shutters;* Philip Warner, Lancaster, Pennsylvania.

Claim.—"Two corresponding silver plated metal flanched plates, in combination with a silver plated knob, attached to an inside bolt, having on the reverse or inside of the plates, corresponding clips, in which the bolt operates—said bolt and clips to be fitted to a mortise in a window shutter, for the purpose of presenting a neat silver plate on each shutter, to hide the bolt, and completely protect it from the weather."

90. For an *Improvement in Governor for Steam Engines;* Marshal Wheeler, Honesdale, Pennsylvania.

Claim.—"The pressure piston, working in an off-set chamber, placed between the throttle and the engine cylinder, and combined with the throttle valve; said pressure piston being made to act against a spring, which simultaneously closes it and the throttle valve, and which yields in proportion to the resistance upon the engine piston, and opens the throttle valve in a corresponding degree."

91. For an *Improvement in Reaping and Mowing Machines;* George W. N. Yost, Pittsburgh, Pennsylvania.

Claim.—"The operating mechanism, or its equivalent, to produce an abrupt and intermittent reciprocating motion, in combination with the inclined edged cutters, and the straight edged cutters, whereby I obtain the shear and chop blow."

92. For an *Improvement in Carriages;* Reuben W. Benedict, Briant, New York.

Claim.—"The combination of the springs with the springs and concomitant parts in such a manner that the torsional motion of the body shall affect the spring."

93. For an *Improved Apparatus for Cutting the Strings that secure Corks in Bottles;* George Blanchard, City of New York.

Claim.—"The internal and slanting arrangement of one or more knives inside the cup, the knife or knives being so arranged in the cup, that when the cup is put over the cork and turned, the strings are immediately cut, and the cork safely received in the top of the cup."

94. For an *Improvement in Platform Supporters;* Charles E. Flagg, Sherburne, Mass.

Claim.—"The improved platform supporter or combination of the fastening bar, the slide bar, the bearer, and the strut, as applied together."

95. For an *Improvement in Potato Diggers;* Amos L. Grinel and John Z. Williams, Willet, Wisconsin.

Claim.—"The two rakes attached to the frames, the frames being hung on the shaft, which is connected to the frame."

96. For an *Improvement in Seed Planters;* Plymon B. Green, Chicago, and Edward A. Kennedy, Newark, Illinois.

Claim.—"The seed slide, in combination with the foot, side springs, and catchers."

97. For an *Improved Rotary Excavator;* Daniel Judd, Hinsdale, New York.

Claim.—"The cylindrical form of the excavator, so formed, in combination with the wheels, windlass, and frame, that the load bears on its centre, and rotates when being raised, and also when being discharged."

98. For an *Improvement in the Mode of Attaching Horses to Shafts of Vehicles;* Geo. B. Kaighn, Lumberton, New York.

Claim.—"Supporting and controlling the ends of vehicle shafts, by means of the loops or tugs secured to the hames, making the breeching (consisting of the band, the adjustable holders, or their equivalents,) a permanent and adjustable part of the said shafts; and attaching the back ends of the traces together at the back end of the said shafts, so as to bear against and move on the pulleys in accordance with the forward motions of the horse; the whole being arranged and operating together substantially as described and set forth, and for the purpose of dispensing with the usual saddle, belly bands, crupper, breech supporting straps, and whiffle tree, and thus facilitating in connecting and disconnecting horses and vehicles."

99. For an *Improvement in Seeding Machines;* C. O. Luce, Freeport, Illinois.

Claim.—"The distributing wheels, in combination with the slides or valves."

100. For an *Improvement in Corn Shellers;* Ebenezer Morrison, Franklin, N. H.

Claim.—"The arrangement of the two toothed truncated feed cones, for both revolving and feeding down the ears of corn, in such a manner that the toothed shelling wheel will remove all the corn from the cob during such revolving."

101. For an *Improvement in Seed Planters;* George A. Meacham, City of New York.

Claim.—" 1st, A machine for planting corn, constructed so as to be applied to, and operated by the foot. 2d, The employment of self-adjusting step, applied in connexion with the plunger and slide seed tube or box, and flexible seed conductor."

102. For an *Improvement in Machines for Stuffing Horse Collars;* H. G. Robertson, Greenville, Tennessee.

Claim.—" In combination with, and specified relation to, the movement of the reciprocating plunger or stuffing rod, the intermittently reciprocating mechanical feed, formed by the bearded racks or toothed slide and retaining fingers, operating together simultaneously in reverse directions within the hopper."

103. For an *Improvement in Straw Cutters;* Thomas Wiles, Somerset, Ohio.

Claim.—"The feed and discharge bottom, in combination with the reciprocating knife projection."

104. For *Improved Breech Loading Fire Arms;* Henry Gross, Tiffin, Ohio.

Claim.—" The breech piece and eccentric lever working together, in combination with the breech seat, to which the axis of the breech is normal at the time of discharging, whereby the pin, around which the breech turns, is relieved, and loosening from recoil prevented."

105. For an *Improved Sabot for Rotating Shot and Shell;* W. W. Hubbell, Philadelphia, Pennsylvania.

Claim.—" The construction of wooden sabot, adapted to relieve the friction of, and easily rotate the smooth spherical shot or shell of the common diameter, consequent weight, form and extent of windage, and bearing of its weight on the bore out of its equal size of smooth bored cannon under the conditions as described."

106. For an *Improvement in Bedsteads;* W. Hentress, South Berwick, Maine.

Claim.—" The pins, when placed in the under side near each end of the slats, and interlaced with the cords."

107. For an *Improved Mode of Attaching Pads to Saddle Trees;* James Ives, Mount Cannel, Connecticut.

Claim.—" The peculiar construction of hinge joint, for connecting the pad to the tree."

108. For an *Improved Method of Operating Head Blocks of Sawing Mills;* Joseph Hurtzeman, Lancaster, Ohio.

Claim.—" Connecting the dogs to the shaft by means of the racks and gearing, in combination with the toothed wheel, having the hollow hub or geared rim attached, the wheel being placed loosely on the shaft which is provided with the pawl."

109. For an *Improvement in Wheel-wrights' Machinery;* A. S. Macomber, Bennington, Vermont.

Claim.—" The jaws operated by the screws, worm wheels, and connecting rods, one pair of jaws being attached to an adjustable bar."

110. For an *Improved Die Stock for Cutting Screws;* Patrick M'Glen, Waterford, New York.

Claim.—" The arrangement of one or more dies, within a circular two-way ratchet, which is moved by adjustable pawls."

111. For an *Improved Rotary Shingle Machine;* Jason Palmiter, Jamestown, N. Y.

Claim.—" Placing a series of carriages on the sides or faces of a polygonal wheel, and giving said carriages the proper feed-motion, by means of the racks, pinions, ratchets, and sliding bar with pawls attached, the above parts being arranged in connexion with the circular saw."

112. For an *Improvement in Repairing Circular Saw Teeth;* M. L. Parry, Galveston, Texas.

Claim.—" The stop or mandrel, fitted within an adjustable socket, which is attached to an arm, the arm being secured to the frame."

113. For an *Improvement in Ice Cream Freezers;* Joseph Parresette, Indianapolis, Indiana.

Claim.—"The spiral scraper. in combination with the drop catcher, for the purpose of regulating the movement of the can and scraper, in relation to each other."

114. For an *Improvement in Attaching Teeth to Sickle Bars of Harvesters;* J. C. and L. C. Pluche, Cape Vincent, New York.

Claim.—"Attaching the teeth of the sickle to the bar, by the cleats secured to the back ends of the teeth, the cleats being fitted in a groove in the bar."

115. For an *Improved Mode of Sounding Whistles for Fog Signals;* R. Porter, Washington, D. C.

Claim.—"The combination of vertical cylinders (or their equivalents), and whistles attached thereto, for the purpose of having loud sounds produced by the undulation of the waves or swells."

116. For an *Improvement in Gutta-Percha Tubing;* James Reynolds, City of N. York.

Claim.—"Constructing the mandrel with a joint."

117. For an *Improvement in Casting Bar Wheels;* L. H. Allen, Assignor to self and E. M. Ivens, Tamaqua, Pennsylvania.

Claim.—"Passing a volume of steam through the eye of a cast metal wheel, whilst the periphery is in the chill, whereby the contraction of the wheel as it cools is equalized."

118. For an *Improvement in Repeating Fire Arms;* A. Hall, Assignor to self and J. G. Caldwell, City of New York.

Claim.—"The ring of chambers, having a single spoke extending from its inner periphery to its hub, so that said ring may turn on a centre support, make almost an entire revolution, and pass freely and truly through the mortise in the breech, when its chambers are in succession brought opposite or incline with the box of the gun. Also, so combining the bolt with the ring of chambers, as that it may be detached from its catch, and the ring turned to bring the next chamber in line by the hand which supports the gun, and without changing the hand from its supporting position."

119. For an *Improvement in Japanning Pins;* John J. Howe and Imman Piper, Assignors to the Howe Manufacturing Co., Derby, Connecticut.

Claim.—"Dipping a portion of the length of the pin in the compound, whilst inserted in a sheet of paper, and with one end downward, and then subjecting them to the baking operation, in combination with the second dipping and baking in the reversed direction to japan the remaining portions. Also, controlling the pin during the process, by sticking the pins into the sheet of paper through holes in a plate of metal, or equivalent substance; the said holes being of sufficient size for the free passage of the shanks or barrels of the pins, but not for the heads, so that after the first dipping and baking, by reversing the pins and pulling off the sheet of paper, the pins will hang by their heads for the second dipping and baking."

120. For an *Improved Machine for Sticking Pins;* J. J. Howe and I. Piper, Assignors to the Howe Manufacturing Co., Derby, Connecticut.

Claim.—"In combination with a guide groove or grooves and a follower, the employment of the sliding frame for holding and shifting the sheet of paper, that the pins may be properly spaced and inserted in the sheet of paper, at right angles or nearly so with its surface. Also, in combination with the guide groove or grooves, follower, and holding and shifting frame, the employment of a perforated plate, and interposed between the guide groove or grooves, and the sheet of paper held in the frame, that the pins may be inserted simultaneously in the plate and in the sheet of paper."

121. For an *Improvement in Metal Beams;* J. K. Ingalls, Brooklyn, N. Y., Assignor to M. H. Howell, City of New York.

Claim.—"1st, The corrugated web, when cast with or upon the top flanch, and arranged with the bottom flanch or tie, in such manner as to afford flexibility to the cast portion of the beam, to accommodate its action to the tension of the wrought portion. 2d, The tapering form of the corrugations in their height, with a right line where the web attaches to the top flanch, with which it acts in resisting compression, and which increases the breadth of said corrugations, and, consequently, the flexibility of the web where it touches the bottom flanch or tie, with which it acts in resisting extension."

JUNE 17.

122. For an *Improvement in Hand Corn Planters;* George Atkins, Pittsburgh, Pa.

Claim.—"Attaching the plate by a hinge or joint, to the lower part of the box—the plate having a curved plate attached to its inner side, which plate is provided with a hole, and works over the curved portion of the plate, which is attached to the lower end of the box—the straight portion of the plate being fitted and working between plates attached to the plate, so that the distributing device may be operated by merely throwing forward the box."

123. For an *Improved Marble Sawing Machine;* Cyrus Avery, Tunkhannock, Pa.

Claim.—"The combination of the sliding bars, link, lever, with the rack and movable stirrup."

124. For an *Improvement in Machines for Thrashing and Winnowing Grain;* Alfred Belchambers, Ripley, Ohio.

Claim.—"The plates or rubbers, placed in the shoe, when the upper plate or rubber is hung upon a shaft, so that it may vibrate laterally, by the shake motion of the shoe."

125. For an *Improvement in Machines for Counting Coin;* M. F. Bonzano, New Orleans, Lousianna.

Claim.—"The manner of passing the pieces in regular order through a slot, by means of a toothed wheel, for the purpose of making them aid, as a pinion to revolve a wheel, connected by other wheels, with a registering index."

126. For an *Improved Machine for Bending Hay Forks;* Nathan Brand, Leonardsville, New York.

Claim.—"The combination and arrangement of the following devices: consisting of the stationary jaw, provided with a ledge or side projection—the disk, with a score for the shank of the fork; the hinged wings or side levers, operated so as to bend the tines around the jaw; the hinged jaw, so arranged as to give the tines the curve required, and press the shank into the score in the die, and give it the proper position in relation to the tines."

127. For an *Improved Saw-Set;* Lebbeus Brooks, Great Falls, New Hampshire.

Claim.—"Arranging the adjuatable angular bed in the jaw lever, and with respect to the jaw and sliding gauge, applied thereto."

128. For an *Improvement in Safety Valves;* Robert Cornelius, Philadelphia, Pa.

Claim.—"The arrangement of the weight and lever of an ordinary safety-valve, as that, as soon as the steam reaches its limit of pressure, the weight shall so change its position, as to open, and keep open, the aperture of discharge of steam."

129. For an *Improvement in Making Sheets of Leather from Curriers' Shavings or "Buffings;"* Charles F. Crockett, Newark, New Jersey.

Claim.—"Making sheets of leather of any desired size and thickness, of curriers' shavings or buffings, by lapping and cementing them together while in a moist state, and then subjecting the mass to pressure."

130. For an *Improvement in Differential Governor for Marine and other Engines;* Charles N. Clow, Port Byron, New York.

Claim.—"Controlling the throttle valve of the engine, by means of pistons and valves, by producing a vacuum on either side of piston, alternately as the motion of the engine may require."

131. For an *Improvement in Ships' Capstans and Windlasses;* James Emerson, Worcester, Massachusetts.

Claim.—"The double or divided capstan or windlass, arranged for operation, and consisting of an upper hand operative portion of the body or capstan proper, and under loose portion of said body, separately controllable by friction strap or gearing at pleasure, with the upper operative portion of the body of the capstan."

132. For an *Improvement in Locks;* Michael Erb and F. C. Goffin, Newark, N. J.

Claim.—"Placing tumblers across the shaft, viz: the end tumblers placed loosely upon it, with washers between them, whereby, a positive action or movement is given to the tumblers—the use of springs dispensed with, and the lock rendered durable, simple, and economical to manufacture."

133. For an *Improvement in Strapping Tackle Blocks;* J. B. Fayette and D. Wheeler, Oswego, New York.

Claim—"A strap, made in two parts, each part having a hook at one end to hook into the eye of the block hook, and a hole near the other end for the bolt that fastens them together."

134. For an *Improved Carriage Springs;* John U. Fiester, Winchester, Ohio.

Claim.—"Forming elastic twisted springs, with elliptical curve, for the purpose of giving to the same greater strength and elasticity, and also, a lateral and vertical motion."

135. For an *Improvement in Silver Plate Cake and Fruit Baskets;* R. Gleason, Jr., Dorchester, Massachusetts.

Claim.—"Attaching the two lids or covers to the box of the basket, by the swivel joint hinges—the lids or covers corresponding in form to that of the body—whereby, the lids or covers may be placed over the body, or turned downward, and secured by the catches underneath the body."

136. For an *Improvement in Molasses Pitchers;* Henry W. Goodrich, Boston, Mass.

Claim.—"Arranging the drip receiver, the pipe thereof, and the discharging end of the pipe, with respect to the nose and neck of a pitcher, in order that when the pitcher is being tipped, for the purpose of pouring from its nose, none of its liquid contents may pass into the mouth of the discharge pipe; the drop receiver and its pipe subsequently serving to catch the drippings from the nose, and convey the same back into the pitcher."

137. For an *Improvement in Certain Devices in Planing Machines;* Valentine Houck, Buffalo, New York.

Claim.—"I ask a patent for the improvements, so that I may either construct a machine combining them, or send the improvements to others, to be used upon machines already constructed."

138. For *Improved Mechanism for adjusting Circular Saws obliquely to their Arbors;* George Hutton, City of New York.

Claim.—"The combination of the two spherical faced and peculiarly perforated movable rollers, with the concave fixed collar, and the concave washer. Also, the employment of the adjusting screws, in combination with the collars, the concave fixed collar, and the concave washer."

139. For an *Improvement in Brushes for Cleaning Travelers;* Henry S. Houghton, Blackstone, Massachusetts.

Claim.—"The application of a brush to the delicate movement of the ring traveler, so as to rapidly clean the same, without breaking down the thread."

140. For an *Improvement in Refrigerators;* Samuel Hickok, Buffalo, New York.

Claim.—"Covering the inside box case, or metallic frame, with woolen flannel or other cloth, in such a manner, that the water, as it drips from the melting ice, will drip, on to and saturate the cloth, and from the cloth, will be conducted out of the case—thereby producing a strata of cold water held in the cloth, and the entire surface of the inner metallic frame, and surrounding the articles to be kept cool."

141. For an *Improvement in Machines for Paring Apples;* Horatio Keyes, Leominster, Massachusetts.

Claim.—"Attaching the cutter head to the bar by a pivot, and having a lip or bearing piece on the cutter head."

142. For an *Improved Valve for Double-acting Pumps;* John C. King, Belvidere, New Jersey.

Claim.—"A single-acting pump valve, with two chambered faces, standing at an angle to each other, and operated by the pressure of the water from the pump cylinder, to answer as suction and delivery valve to a double-acting pump."

143. For an *Improvement in Brick Presses;* Lewis Kirk, Reading, Pennsylvania.

Claim.—"The oscillating mould chamber, in combination with the clay guard, concentric with its trunnions, and the piston, actuated by the oscillation of the mould chamber."

144. For an *Improved Door Lock:* Christian Knauer, Birmingham, Assignor to Warwick, Attlebury & Co., Pittsburgh, Pennsylvania.

Claim.—"Actuating the bolt of a right and left hand lock, by means of a tumbler, which has a vertical motion, for the purpose of freeing and securing the bolt; and also, a vibrating motion, for throwing in or out, the tumbler being arranged in relation to the key in such a manner, that the bolt will be thrown out the same distance in whichever way the key may be inserted."

145. For an *Improvement in Ploughs;* N. S. Lockwood and J. D. Winn, Dayton, O.

Claim.—"Welding the post or 'breast' to the mould-board, and attaching the share and land-side to the mould-board and post, or 'breast,' by means of the flanch at the lower end of the post or breast, and the plate of the share and land-side, through which flanch and plates the screw bolts pass."

146. For an *Improvement in Feeders for Roller Cotton Gins;* L. J. Mallard and Wm. S. Baker, Riceboro', Georgia.

Claim.—"The combination of the screen with the revolving toothed cylinder, when so placed in relation to the ginning rollers, that any excessive accumulation of cotton between them shall be removed or prevented, and the excess be retained between the cylinder and screen, until its quantity shall be equalized and relieved by the gin."

147. For an *Improvement in Adjustable Punches for Setting Artificial Teeth;* Samuel Mallett and Augustus B. Smith, New Haven, Connecticut.

Claim.—"The combination of two punches—one immovable, the other movable in the slot, with a spring, and the two cavities—one in the plug or immovable punch, and the other movable, with the movable punch; the latter to be set by the insertion of the wires of the teeth into said cavities, in order to make the distance between the holes in the plate correspond with the distance of the pins in the teeth."

148. For an *Improvement in Odometers and Counting Machines;* Joseph L. Martin, Baltimore, Maryland.

Claim.—"1st, The attachment of a friction clutch to the ratchet-lever, operating against the bar of the connecting rod, for producing the requisite motion in the first wheel—so arranged, that any excess of motion in the bar will not produce excess of motion in the wheel; and I claim this, whether in combination with the ordinary train of wheel work, with a single or double ratchet pawl; or in combination with the arrangement of wheel work. 2d, The combination of the cam, (whose axis is attached directly to the carriage axle,) with the connecting rod and frictional clutch upon the ratchet lever."

149. For an *Improvement in Cartridges;* Edward Maynard, Washington, D. C.

Claim.—"My improved cartridge for breech loading fire arms, composed of a hard metal cylindrical case, charged with powder, and combined with a projectile of such shape, that whether the case receive a large or a small charge of powder the said projectile is self-retained in contact with the powder, in such a position, that its point must be coincident with the axis of said case, and a perfectly tight joint formed between said projectile and case, by filling the grooves in the former with greasy matter."

150. For an *Improvement in Non-elastic Bands for bales of Cotton, and other fibrous substances;* David McComb, Memphis, Tennessee.

Claim.—"The combination of the link or slide with the hooked ends of hoops, for the purpose of securing them from opening with the expansive force of the bale. Also, the peculiar formation of the link, which forms a secure means of keeping the hooked ends of the hoop together, and has a guard which keeps it to its place, is easy of application in putting on, and may be removed at pleasure, without mutilation."

151. For an *Improvement in Smoothing Irons;* Oscar F. Morrill, Boston, Mass.

Claim.—"Attaching to the iron, a vessel or receptacle for containing alcohol, or other spirit, constructed with a spout or chamber, into which the spirit is conducted by a wick, and heated by a flame properly applied thereto—the said spout or chamber having attached to it, and communicating with it, a small tube, through one orifice of which, the gas or vapor thus generated is forced in a jet, and ignited by coming in contact with the flame employed for generating the gas—by which arrangement, a jet of flame is made to impinge upon the hollow chamber of the iron. Also, constructing the iron with a partition at the rear portion of the iron."

152. For an *Improvement in Clutch for Flour Packers;* John T. Noye, Buffalo, N. Y.

Claim.—"The clutch, formed by the hollow shaft, with slots and chamber, in connexion with the round shaft, with driving pins and balance or slide guard, to drive the pins up into the chamber."

153. For an *Improvement in Harvesters;* J. C. and L. C. Pluche, Cape Vincent, N. Y.

Claim.—"The frame, when arranged in respect to the driving shaft, and having the bar attached to its lower end—and the strips attached to the bar—the upper ends of the strips having a roller attached to them, which roller is fitted and works in a guide, the finger bar being connected to a shaft fitted within the bars."

154. For an *Improvement in Auger Handles;* N. C. Sanford, Meriden, Conn.

Claim.—"Fastening the stick or handle in the eye of the auger shank, by means of the screw passing through the eye, handle, and into a recess in the shank, in combination with the clamp or screw-plate on the under side of the stick, within the eye, and operated by the screw."

155. For an *Improvement in Machines for Paring Apples;* John D. Seagrave, Worcester, Massachusetts.

Claim.—"The attaching the spring to the rod, so as to hold or return the knife to nearly right angles to the line of motion, to or from the centre."

156. For an *Improved Port-Folio;* James Shaw, Providence, Rhode Island.

Claim.—"The roller, attached to the covers, provided with the grooves and rings which are fitted in the grooves."

157. For an *Improvement in Corn Harvesters;* W. S. Tilton, Boston, Mass.

Claim.—"The rotating cutters and stationary knife, placed within an adjustable frame."

158. For an *Improved Method of Operating Cutters in their Heads for Irregular Forms;* John Tear, Chicago, Illinois.

Claim.—"The use of a cutter head, in which the knives or cutters are caused to traverse during the rotation of the cylinder, for the purpose of adapting themselves to the shape of the thing to be cut by them."

159. For an *Improvement in Machines for Sizing Hat Bodies;* Joseph Thomas, Brooklyn, New York.

Claim.—"1st, Combining with the wheel, the wheels, (or their mechanical equivalents,) for giving the main wheel a vibrating motion, when used with a stationary plate or bed, in order to rub the goods back and forth; and, also, in combination therewith, the mechanism for giving the main wheel the constantly advancing motion. 2d, Combining and arranging the circular plate or bed and table, in such a manner, that by the levers (or their equivalents,) and cords, the same mechanism may adjust the plate to the wheel, and also the table to the ratchet rollers—and thus give any pressure desired to the goods."

160. For an *Improvement in Coal Heating Bakers;* Jesse D. Wheelock, Mayville, Wisconsin.

Claim.—"The use of the descending flue or tube, in two parts—the one sliding into the other, so that the same can be lengthened or shortened at pleasure for the purpose of passing off the fumes and smoke of the coal burned in the chamber, in combination with the said chamber, and the perforated bottom for baking purposes."

161. For an *Improvement in Water Heaters surrounding Fire-pots of Cooking Apparatus;* Edward Whitely, Boston, Mass.

Claim.—"1st, The diagonal partition between the pipes. 2d, The inclined roof of the heater, for the purpose of expelling the air therefrom."

162. For an *Improvement in Revolving Harrows;* Garret J. Olendorf, Middlefield, New York.

Claim.—"The construction and combination of the several parts of my revolving harrow."

163. For an *Improvement in Pre-Tanning Compositions;* Israel P. Williams, Salem, Massachusetts.

Claim.—"Subjecting the hides, after the "lining" and "drenching" of them, preparatory to their being immersed in the tanning liquor, to the action of a bath of the carbonate of soda and nitre, and one of an acid solution or mixture."

164. For an *Improvement in Saponifying Fats;* George T. Wilson and George Payne, Belmont, Vauxhall, England.

Claim.—"Our improved process of treating them, so as to distil over glycerine with fat acids mixed, but uncombined."

165. For an *Improvement in Welding Iron Plates;* Wm. Bertram, Woolwich, England, Assignor to John W. Cochran, City of New York.; patented in England, December 21, 1854.

Claim.—"Welding the separate faces of such bars or plates together, by pressure or concussion, while at the same time they are subjected to opposite blasts of heat."

166. For an *Improvement in Mowing Machines;* Cornelius Aultman and Lewis Miller, Assignors to Ball, Aultman & Co., Canton, Ohio.

Claim.—"Connecting the cutter bar to the machine, by the double rule joint, or the double jointed coupling piece."

167. For an *Improvement in Compositions for Working Steel;* Horace Vaughn, Providence, Rhode Island.

Claim.—"The dry chloride of sodium and bi-chromate of potash, with or without the prussiate of potash, for hardening and tempering steel."

168. For an *Improvement in Reflecting Quadrants;* Thomas Hedgcock, County of Surrey, England; patented in England, March 31, 1855.

Claim.—"The detector glass, in combination with the index glass and horizon glass, for the purpose of facilitating observations."

JUNE 24.

169. For an *Improved Self-setting or Self-raking Saw for Sawing Machinery;* Aza Arnold, Washington, D. C.

Claim.—"The combination of a retreating motion, with the edged reciprocating saw; by which combination, I can give any desired adjustment of cut and feed at pleasure, to enable the saw to cut during its whole descent."

170. For an *Improvement in Printing Instruments for the Blind;* A. Eley Beach, Stratford, Connecticut.

Claim.—"1st, Causing the types to strike at a common centre. 2d, Connecting each of the type keys, or their equivalents, with the escapement, by means of a common connexion."

171. For an *Improvement in Smoothing Irons;* Leander M. Bonyton, Worcester, Mass.

Claim.—"Forming the lower part of the iron with side walls projecting above the upper surface thereof, for the double purpose of securing the upper portion to the lower portion, and directing the draft in heating the upper surface of the said lower portion. I claim only the mode of construction."

172. For an *Improvment in Hemp Breakers;* R. W. Bowen, Marshall, Missouri.

Claim.—"The peculiar construction of the upper and lower blades of the brake, so that they shall approach each other at the same moment, but with different velocities; that is to say, pivoting the lower blades, at or near their front ends, in a firm frame, and connecting their rear ends to the top blades, which are pivoted at a point about two-thirds of their length, in a solid frame, and operated in front."

173. For an *Improvement in Fire Arms;* Fordyce Beals, New Haven, Conn.

Claim.—"The arrangement and combination of parts, using the arm pivot or axis, in connexion with the pawl and hammer, for the purpose of rotating the chambered breech or cylinder—using the arm pivot or axis in its combination and arrangement of parts."

174. For an *Improved Alarm Lock;* Julius Cone, Yellow Springs, Ohio.

Claim.—"Disconnecting the knob-shaft from the latch-bolt; thereby dispensing with a key, key-hole, separate key, bolt, and all devices for operating a key-bolt. Also, placing the alarm spring and scape wheel upon the knob-shaft itself, when combined with the arrangement for connecting said knob-shaft with, and disconnecting it from the alarm, so that said alarm may not interfere with the ordinary use of the lock, simply for a latch. Also, the disk constructed and operating in connexion with the bolt, alarm, and 'ward spring.' Also, the ward spring. Also, the notch in the knob-shaft, in combination with the slot in the bolt."

175. For an *Improved Mode of Securing Shafts to Axles;* William Cox, Doylestown, Pennsylvania.

Claim.—"The two bars, with the jaws attached to them; the bar being elastic, and having a screw passing through it, on which a nut is fitted—the bars being attached to the axle."

176. For an *Improved Vise;* Horace B. Chaffee, City of New York.

Claim.—"The supplementary jaw, pivoted to the stationary jaw of the vise, and connected with the weighted pawl."

177. For an *Improvement in Lime and Guano Spreaders;* William Croasdale, Hartsville, Pennsylvania.

Claim.—"The combination of the cylinder, composed in part of the movable strips with the rubbers."

178. For an *Improvement in Locomotive Lamps;* Samuel E. and Henry B. Cleveland, Buffalo, New York.

Claim.—"The arrangement and combination of the valve with the plunger and spring, for the purpose of forcing the oil from the can or reservoir, to the burner or wick."

179. For an *Improvement in Rotary Pumps;* Stephen D. Carpenter, Madison, Wis.

Claim.—"The cones, connected by the propellers, in combination with the diaphragm or disk. Also, the semi-spherical shells, in combination with the conducting pipes."

180. For an *Improvement in Reapers;* Owen Dorsey, Triadelphia, Maryland.

Claim.—"Driving the sickle or communicating motion thereto, by means of the crank-pulley, pitman, arms, and shaft, whereby four vibrations of the sickle are obtained at every revolution of the crank-pulley."

181. For an *Improved Water Wheel;* Wilber M. Davis, Carmel, Maine.

Claim.—"The combination of the scroll plate and water pitchers, to secure more beneficially the direct action of the water, in combination with the cone, spreading the bottom of the wheel with a curved float, narrowed at the bottom, and set spirally upon the cone, which, with the scroll plate and pitchers, secure the full direct action and reaction force of the water upon the weeel."

182. For an *Improvement in Shoemakers' Edge Planes;* Isaac A. Dunham, North Bridgewater, Massachusetts.

Claim.—"My improved tool, having part of its moulding edge stationary, and formed with a cutting edge; and the other part of said moulding edge made movable, with respect to the first, and so, that while cutting with the tool, the moulding surface of both parts may rest in contact with the material which is to be cut—my tool enabling me, also, to polish the reduced surface, while a shaving is being removed."

183. For an *Improved Method of Cooling and Drawing Fluids from Casks, &c.;* F. Espenschade, Williamsport, Pennsylvania.

Claim.—"The vessel, provided with an ice chamber, and having a pump connected with it, and the vessel communicating with the barrel by means of the pipe."

184. For an *Improved Method of Felling Trees by Saws;* George C. Ehrsam, City of New York.

Claim.—"The collar or band, with annular rotating rack or rim attached, and the, chisel or cutter, fitted within the socket, which is attached to the rack or rim, the chisel or cutter having portions of screw threads on its under side, which fit between a spiral thread on the collar or band."

185. For an *Improved Mode of Detaching Horses from Vehicles;* Francis M. English Hopkinsville, Kentucky.

Claim.—"The combination of pins with the levers."

186. For an *Improvement in Hanging Grindstones;* David Hinman, Berea, Ohio.

Claim.—"Hanging grindstones, having the shaft and flanch with or without a cast in one piece, with the stone firmly secured thereto by the shrinking of the metal."

187. For an *Improvement in Adjustable Cut-offs for Steam Engines;* Henry J. and Thomas Hawkins, Mobile, Alabama.

Claim.—"The adjustable cam and self-inserting toe, which, when combined together on any rock shaft motion for working steam valves, can cut off the steam at any given point, on either motion of the piston, at a moment's notice."

188. For an *Improvement in Seed Planters;* George Hall, Morgantown, Va.

Claim.—"Hanging the cams that operate the seed slides, to the face of the drive wheel, so that they can be swung into or within recesses cut in the face of said wheel, for the purpose of adapting the machine to planting at variable distances apart."

189. For an *Improvement in Plotting Instruments;* Charles R. Iliff, Falmouth, Ky.

Claim.—"The combination of the trammel with the drawing stand, which is provided with the angular and offsett adjustments, whereby an instrument of greatly increased capability is produced."

190. For an *Improved Wrench for Gas Pipe, &c.;* Gustavus A. Jenks, Worcester, Massachusetts.

Claim.—"Arranging the hook or claw and the spring, with respect to the slide and the main bar, and hinging or jointing the claw directly to the slide."

191. For an *Improved Envelope;* Robert T. Knight, Philadelphia, Penna.

Claim.—"The lapping of the ends of the envelope, when they are to be secured by metallic eyelets."

192. For an *Improved Arrangement of Means Attached to Ice Boats;* Daniel Large, Philadelphia, Pennsylvania.

Claim.—"The arranging in the after part of the boat, of the two troughs, for throwing by the power and impulse given by the paddle-wheels, the broken and floating ice upon the fast ice, on each side of the channel, and thereby keeping the water clear for the passage of vessels."

193. For a *Portable Field Fence;* Benjamin F. Lyon, Pleasantville, Penna.

Claim.—"1st, The construction of the mortise in my fence posts. 2d, The construction of my rails, with the shoulders and ends of the dove-tail round; and, also, with the dove-tails made reverse, and on the opposite sides of the rails."

194. For an *Improvement in the Running Gear of Carriages;* Richard Murdoch, Baltimore, Maryland.

Claim.—"The swivel bar and boxes, in combination with the short rails connected with the extremities of the cross bar."

195. For an *Improved Tool for Cutting Metals;* John Mooney, Providence, R. I.

Claim.—"The use of the blade or cutter, of a separate piece of metal inserted in an adjustable clamp."

196. For an *Improved Method of Turning Tapering Forms;* H. E. Salisbury, Platea, Pennsylvania.

Claim.—"The manner for operating the revolving cutters, by means of cam, lever, movable face plate, with radiating arm passing through slots, with slides on revolving face plates, for the purpose of opening and closing the cutters, and holding the timber stationary. Also, the movable centre-piece, operating in combination with the feed motion."

197. For an *Improvement in Running Gear of Vehicles;* Henry Phelps, White Hall, North Carolina.

Claim.—"The combination of the elastic rods, with the rods jointed at *f*."

198. For *Improved Tubular Elastic Valves;* Franklin Peale, Philadelphia, Penna.

Claim.—"The method of adapting flexible valves to flexible tubes, and inserting them therein."

199. For *Self-regulating Wind Wheels;* Francis Peabody, Salem, Mass.

Claim.—"Regulating the velocity of the wind wheel, by means of the secondary blades."

200. For an *Improvement in Hand Seeding Machines;* Silas G. Randall, Rockford, Illinois.

Claim.—"In combination with the reciprocating motion of the seed slide, the locking and unlocking of it, at each planting operation, so that the tongue shall be firmly held against the resistance of the earth in forcing it out, and the sheath therein."

201. For an *Improved Machine for Making Rake Teeth;* Charles R. Soule, Fairfield, Vermont.

Claim.—"The shaft, with loose pulley and projection attached, and used in connexion with the frame and lever, with rod attached, and the lever connected with the arm, having the spring attached, the arm having the lever secured to its end."

202. For an *Improved Pug Mill for Mixing Clay;* Carl T. Schlickeysen, Berlin, Prussia; patented in England, Feb. 24, 1856.

Claim.—"1st, The employment of the clearing knife, in combination with the hopper, the tapering case and beaters. 2d, The rotating bottom, in combination with the beaters."

203. For an *Improvement in Fountain Lamps;* Nicolaus Linden, Jersey City, N. J.

Claim.—"Constructing the reservoir of two cylinders,—one placed within the other, the inner cylinder being provided with a valve, attached to springs; said valve being opened at the proper points, by the projections on the inner side of the cylinder."

204. For an *Improvement in Washing Machines;* V. R. Stewart, Weedsport, N. Y.

Claim.—"The combination of the corrugated or fluted cylinder, and reciprocating board."

205. For a *Tidal Alarm Buoy;* John Taggart, Roxbury, Mass.

Claim.—"The combination and arrangement of the air tank, the stream or current wheel, the bell and mechanism for causing said bell to be sounded during the rotary movements of the wheel, produced by the action of a current in the water. Also, arranging or combining with the stream wheel, the bell, the striking apparatus and air tank, the enlosing or guard frame, and the pendulum or weighted lever applied thereto, the same operating together."

206. For an *Improvement in Safety Hatches for Warehouses;* Wm. H. Thompson and Eustis P. Morgan, Biddeford, Maine.

Claim.—"An elevator, having arms or guides attached to the traveling car or platform, either above or below it, together with the sliding or hinged movable doors, which remain closed when the elevator is not in use, and are opened by the action of the car, or suitable attachments to the same, as it passes upwards or downwards through the several stories of the building."

207. For an *Improvement in Fire Arms;* James Warner, Springfield, Mass.

Claim.—"1st, The combination of the recoil and adjusting pin, with the revolving breech placed in the shield plate, in such position, that the point shall be in line with the barrel. 2d, Forming cavities in the battery plate, in such position, and of such form as to receive and hold the ball or balls, in case of the accidental discharge of any of the chambers not in adjustment with the barrel."

208. For an *Improved Dividing Shoe for Mowing Machines;* Walter A. Wood, Hoosick Falls, New York.

Claim.—"The particular form and construction of a dividing shoe for mowing machines, by means of which, the grass on either side of it is divided and bent over, without breaking or crushing, so that the sickle will reach it all, and thus prevent combing or ridging."

209. For an *Improvement in Harvesters;* Cyril B. Wagner, Philadelphia, Pennsylvania.

Claim.—"In combination with the main supporting and driving-wheel, and the main frame and its supporting wheel, the tongue frame, so united, that the motion of one shall not injuriously affect the action of others."

210. For an *Improved Cutting Apparatus for Harvesters;* Cyril B. Wagner, Philadelphia, Pennsylvania.

Claim.—"Forming the finger or guard, having said depression, with an additional depression, and so uniting the sickle and sickle bar thereto, as to facilitate and render easy the cutting."

211. For an *Improvement in Safety Cans for Burning Fluids;* Seth E. Winslow, Philadelphia, Pennsylvania.

Claim.—" The conical form of the wire cloth strainer, with a small aperture at its apex or side, which may be adapted to the lower part of the lamp tops, and to cans."

212. For an *Improvement in Operating Cut-off Valves for Steam Engines;* Wm. Wright, Hartford, Connecticut.

Claim.—" So combining the lifting toe with the lift rod, by means of a supplemental toe or slide bolt, that the arc or curve described by the vibration of the lifting toe, shall effect a lateral movement of the bolt, thereby tripping the valve."

213. For an *Improvement in Cut-off Valve-checks for Steam Engines;* Wm. Wright. Hartford, Connecticut.

Claim.—" The arrangement for retarding the descent of the valve, namely, the combination of the bell crank with the valve on the one part, and the dash-pot, or equivalent resisting apparatus, on the other ; so coupled and operating, that the arm of the crank to which the valve is attached, shall be approaching its greatest throw, thereby checking the rate of descent of the valve, by a force compounded of the diminished speed and diminished pressure."

214. For an *Improvement in Spring Bottom Bedsteads;* Alvah Foot, North Blandford, Assignor to self and Ira Russell, Dedham, and A. B. R. Sprague and Henry Phelps, Worcester, Massachusetts.

Claim.—" Combining with the bedstead and its system of bands and springs, the extension devices or bars, and screws, whereby advantages are obtained."

215. For an *Improvement in Grain Drills;* Abraham Fravel, Assignor to self and Thos. D. Lemon, La Porte, Indiana.

Claim.—" The combination of tooth, cutter, and lever, with shoe, guard, and tumbler."

216. For an *Improved Method of Operating Steam Valves of Steam Pumps;* Remy Henry, Melrose, N. Y., Assignor to James Smith, City of New York.

Claim.—" 1st, Giving motion to the steam valve of a steam pump, by the alternate action of the steam and pump pistons. 2d, The combination of the sleeve, the lever, the fork, and the spring, to communicate the requisite movement to the steam valve."

217. For *Shields to Protect Breastpins;* John H. Phillips, Assignor to Leigh R. Holmead, Washington, D. C.

Claim.—" The employment of a shield or plate, with one or more lips or lugs."

218. For an *Improved Farm Gate;* George Taylor, Richmond, Assignor to Harrison Ogborn and George W. Stigleman, Wayne County, Indiana.

Claim.—" The combination of a gate with the angular lever in such a manner, and so related to each other, that the gate shall stand upon a level, both when open or closed. And, further, the combination of the cam with the lever, or its equivalent, for the purpose of vibrating the levers,—thereby opening and closing the gate."

219. For an *Improvement in Looms;* Lucius J. Knowles, Warren, Massachusetts.

Claim.—" The application of the spring to the jack, the vibrator, the toothed cylinder, under their arrangement, in order to enable the cylinders not only to effect the movements of the vibrator by the aid of its spring, but to be continuously rotated or maintained in constant and not intermittent rotary motion. Also, combining the double shuttle or drop box, with one of the levers or jacks, by means, viz: the rod, the elevator, the friction roller, and slide bar; and so that such drop box may be operated by the toothed cylinder of the harness levers or jack."

ADDITIONAL IMPROVEMENTS.

1. For an *Improvement in Breech Loading Fire Arms;* Abner N. Newton, Richmond, Indiana ; patented June 27, 1854 ; additional dated June 17th, 1856.

Claim.—" 1st, A swivel jointed cylindrical breech pin, the rear portion of which is armed with lugs, and studs, and an inclined plane. 2d, The locking of the cylindrical breech pin, rotating on slightly inclined planes, said planes formed within the barrel on opposite sides, and at the rear of the mortise. 3d, The peculiar combination and arrangement of the four parts or pieces of an ordinary gun lock, to wit: the hammer, main-spring, tumbler, and feather spring; making one plain simple piece. 4th, I claim the slotted thumb lever, in combination with the studs, whereby the swiveled breech is caused to rotate from left to right, and from right to left, in locking and unlocking said breech, and whereby the breech is also moved back and forth."

RE-ISSUES FOR JUNE, 1856.

1. For an *Improvement in Self-Sealing Preserve Cans;* Robert Arthur, Philadelphia, Penna.; patented Jan. 2d, 1855; re-issued June 10th, 1856.

Claim.—"The employment of elastic packing, arranged in, and retained by, a groove of an acute form, or whose sides are in close proximity."

2. For a *Machine for Cutting the Threads of Wood Screws;* Cullen Whipple, Assignor to self, and the New England Screw Co., Providence, Rhode Island; patented August 18th, 1842; re-issued March 5th, 1850; re-re-issue June 13th, 1856.

Claim.—"1st, In combination with the shaft or mandrel which gives the rotary motion to the screw blank, the employment of the rotating wedge-formed cam, or the equivalent thereof, for determining the pitch of the thread, and for permitting the return motion to repeat the operation. 2d, Causing the chaser or cutter at each successive cut, to approach nearer to the axis of the screw blank, by means of a revolving conical cam, which at each successive operation acts by a greater radius. 3d, Governing the motions of the chaser or cutter, to make the core or body of the screw of a conical or tapered form along the whole or any part of its length, by combining therewith a cam of gradually enlarged diameter, the form of such cam depending on the form intended to be given to the core or body of the screw. 4th, Combining the cam which determines the form of the core or body of the screw, (to make it tapering or conical in whole or in part,) with the chaser or cutter by means of a rock-shaft and adjusting lever, the said adjusting lever being interposed between one of the arms of the rock-shaft and the face of the cam, so that by the use of a set-screw, or other analogous device, the cutter or chaser may be readily set. 5th, Shifting the cam which determines each successive cut of the chaser or cutter, by combining therewith, a ratchet movement operating by an eccentric or cam, the wheel of the ratchet being provided with pins which operate a lever connected with the cam to shift. 6th, Disconnecting the shaft or mandrel from the driving power at the end of each complete operation of the machine, by combining the clutch, or the equivalent thereof, with the ratchet, by means of an index wheel or perforated rim, which at the required periods liberates or acts upon the connexions of the clutch, to disengage it. 7th, Making the chaser or cutter, for chasing or cutting the threads of wood-screws by machinery, with a groove of the form of the thread in its cutting face, and in the direction of its length, whereby the said chaser can be sharpened by simply grinding off at the end, and without changing the form of the groove, and whereby, also, the said chaser cuts on both sides of the thread, and finally on the edge thereof. 8th, The combination of the screw driver, for holding and rotating the screw blank, with the tubular rest open at the side to support the shank of the blank while being threaded."

3. For an *Improvement in Bellows for Musical Instruments;* Jeremiah Carhart, City of New York; patented December 28th, 1846; re-issued June 24th, 1856.

Claim.—"The combination of the reeds with an exhaust chamber of variable capacity, and an air pump whose action exhausts and rarifies the air therein, the exhaust chamber tending to expand with a force that will balance the rarification to be preserved in the chamber."

4. For an *Improvement in Annealing Furnace;* J. Joseph Eagleton, City of New York; patented May 20th, 1856; re-issued June 24th, 1856.

Claim.—"Charging and discharging an annealing furnace in bulk. Also, opening the bottom of the annealer for the purpose of discharging its contents, and re-charging it. Also, the employment of a continuous heat, with an air-tight annealer, by which iron wire can be annealed with the same facility as brass and copper, where the air is not required to be exhausted."

DESIGNS FOR JUNE, 1856.

1. For *Cooking Stoves;* William Resor, Cincinnati, Ohio; June 3d, 1856.

Claim.—"The design for the 'Lotus' cooking stove."

2. For *Cooking Stoves;* William Resor, Cincinnati, Ohio; June 3d, 1856.

Claim.—"The design for the 'Kentucky' cooking stove."

3. For *Stoves;* Isaac Diller, Lancaster, Penna.; June 17, 1856.

Claim.—"The arrangement, &c., of ornaments for a parlor oven stove."

4. For *Cooking Stoves;*
5. For *Air-tight Stoves;*
6. For *Nine-Plate Stoves;*
7. For *Stoves;*

G. Smith, H. Brown and J. A. Reed, Assignors to Abbott & Lawrence, Philadelphia, Pennsylvania.

Claims.—"To the design, &c., of the ornaments and mouldings in bas-relief, &c."

8. For *Stoves;* Samuel W. Gibbs, Assignor to Treadwell, Perry & Norton, Albany, New York: June 17, 1856.

Claim.—"The combination, &c., of the ornamental figures and forms."

9. For *Cooking Stoves;* Stratton & Massey, Assignees of John F. Allen, Philadelphia, Pennsylvania; June 17, 1856.

Claim.—"The general form and proportions, combined with the mouldings, figures, and ornaments."

10. For *Stoves;* Samuel W. Gibbs, Albany, New York, Assignor to North, Chase & North, Philadelphia, Penna.; June 24th, 1856.

Claim.—"The design, &c., of the mouldings and ornaments."

11. For *Stoves;* Samuel F. Pratt, Boston, Mass., Assignor to Treadwell, Perry & Norton, Albany, New York; June 24th, 1856.

Claim.—"The combination, &c., of the ornamental forms and figures."

12. For *Stoves;* N. S. Vedder and Wm. L. Sanderson, Troy, New York, Assignors to North, Chase & North, Philadelphia, Penna.; June 24th, 1856.

Claim.—"The design, &c., of the ornaments and mouldings."

13. For *Cooking Stoves;* G. Smith, H. Brown and J. A. Read, Assignors to Leibrandt, McDowell & Co., Philadelphia, Pennsylvania; June 24th, 1856.

Claim.—"The combination of the various ornaments and mouldings on the several plates and doors."

MECHANICS, PHYSICS, AND CHEMISTRY.

*On the Commercial Economy of Working Steam Expansively in Marine Engines.** By Mr. Edward E. Allen, of London.

(Continued from page 57.)

Referring now to Section D, Table XXIII, it appears that by using steam of 80 lbs. pressure instead of 35 lbs., the annual saving in coal will amount to $14\frac{1}{4}$ per cent. of the original capital; and that the same quantity of coals will last ninety-three days instead of forty. Also, if the pressure be increased to 120 lbs., the annual saving in coal will amount to $16\frac{1}{4}$ per cent. on the original capital; and the same quantity of coals will last 114 days instead of 40.

Again, if instead of carrying coals for an additional number of days, the space they would occupy, be appropriated to cargo, then, by the central columns, on the supposition that the total machinery and coal-space, is equal to $\frac{2}{3}$ds of the total cargo-space, the latter will be increased 12 and 18 per cent. when the size of the engines is increased to two and three times respectively, and 24 and $27\frac{1}{3}$ per cent. when the pressure is increased to 80 and 120 lbs. respectively. By the last columns of Section D., it will be seen, that, on the same supposition, and supposing the net profits for two years, to be equal to the cost of vessel, that is, the receipts on the cargo-space to be 50 per cent. of the original capital, then the total annual gain, from saving in coals and increase of cargo-space, will be 13¼ and 19¾ per cent. of the original capital, when the size of the engines is increased to two and three times respectively, and 26¼ and nearly 30 per cent. when the pressure is increased to 80 and 120 lbs. respectively.

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* From the London Artizan, April, 1856.

These results are of the highest importance, and well deserve the consideration of those embarking capital in undertakings of this nature.

In concluding this examination of the beneficial effects of expansion, the author may remark, that there are various aspects and suppositions under which they might be demonstrated, and few can be more fully aware than himself of the imperfection which might be found in these contributions to the subject. It is difficult to present a comprehensive view of the subject in an abstract form; but perhaps enough has been done to serve as a ground-work upon which calculations suited to specific cases can be based; this may be done by substituting the correct quantities in any particular case, for those given in the Tables.

TABLE XXIII.—SECTION D. GENERAL SUMMARY.

Table compiled from the three foregoing Tables; the cost, weight, and space of engines, boilers, and passages, and water, being constant; the pressure increasing from 35 *to* 80, *and* 120 *lbs.* (*the intermediate pressures being omitted*), *the size of nominal* H. P. *of the engines, and the indicated* H. P. *remaining the same.*

Class.	Service.	Total pressure of steam in lbs. per square inch.	Annual saving of coal in per centage of capital (Table XVIII).	Increase of capital per cent.	Total weight of coal and machinery; decrease per cent (deduced from column 6, section A).	Total spaces occupied by coal and machinery; decrease per cent (deduced from column 6, section B).	Cargo space: increase per cent.			Per centage of increase of time the coals would last, if total weights be kept the same.	Number of days the coals would last, if total weights be kept the same.	Annual per centage gain of capital from saving of coal and increase of cargo-space.	
							When total machinery and coal space is *equal* to total cargo-space.	When total machinery and coal space is *2-3rds* of total cargo-space.	When total machinery and coal space is *half* of total cargo-space.			If the net profits cover cost of vessel in one year.	If the net profits cover cost of vesssel in two years.
					Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.		Per Cent.	Per Cent.
1	River.	35	...	Capital constant; the same engines and boilers, &c., being used in all cases	....	....	....	...	...	....	2¼	....	....
		80	8·55		11·00	14	14	9⅓	7	132	5¾	17·88	13·21
		120	9·75		13·00	17	17	11⅓	8½	185	7	21·08	15·41
2	Coasting and Continental.	35	...		....	....	....	....	....	....	10	....	....
		80	2·85		28·50	29	29	19⅓	14½	132	23	22·18	12·51
		120	3·25		32·50	33	33	22	16½	185	28	25·25	14·25
3	Ocean (short voyages) and Government	35	...		....	....	....	....	....	....	15	....	....
		80	2·85		34·00	29	29	19⅓	14½	132	35	22·18	12·51
		120	3·25		39·00	33	33	22	16½	185	42¾	25·25	14·25
4	Ocean (long voyages) Australian.	35	...		....	....	....	....	....	....	40	.....	....
		80	14·25		45·60	36	36	24	18	132	93	38·25	26·25
		120	16·25		52·00	41	41	27⅓	20½	185	114	43·58	39·91
5	Ocean (voyage out and home).	35			....	....	....	....	....	....	70	....	....
		80	2·85		49·87	36	36	24	18	132	162	26 85	14·85
		120	3·25		56·87	41	41	27⅓	20½	185	200	30·58	16·91

In the former paper the author made a deduction from the annual saving in coal, for the interest on the extra capital required for larger engines of the ordinary construction; but no provision was made for the repayment of such extra capital. This might be rendered more simple, by supposing the gain from saving in coals and increased cargo-space, to be set aside until the extra capital was repaid. This would be done in a few years, according to the ratio which the annual profits bore to the capital. After the repayment of the extra capital, the annual gain would be constant, and no reduction would have to be made for interest, the profits resulting from saving of coal and increase in cargo-space.

The author will now refer to the advantages contemplated in the new forms of engines proposed in the former paper, which are as follows:—

1st. That the steam on its entrance to the cylinder, acting on a comparatively small area, would admit of the pressure being considerably increased, without the weight of the engine being increased to anything like the extent, necessary in the case of a common cylinder of large area.

2d. That in order to work expansively, it would not be necessary to increase the length of the cylinder or stroke of the engine, which would be the case with an ordinary engine: the double expansion rendering the length of cylinder virtually double.

3d. That the arrangements proposed possess all the advantages of compactness obtained by the use of a trunk, thus conveniently allowing of a longer connecting rod than would be possible in any other way in the same space.

4th. That upon either of the plans represented in the Drawings, (see *Journ. Frank. Inst.*, vol. xxxi., pp. 336-37–38,) the power of the engines could be almost indefinitely increased, not only by using steam of higher pressure, but also by increasing the *diameter* of the large cylinder; retaining a short stroke for the sake of getting sufficient speed for a screw-engine.

5th. That the floor-space required for the engines, on these plans, would not exceed from $\frac{1}{4}$ to $\frac{1}{2}$ of a sq. ft. per nominal H. P., or about half the space usually occupied by other direct acting engines; the pressure and degree of expansion, being supposed to be in both cases the same.

6th. That the space required for the engines, so as to obtain a greater degree of expansion than usual, (greater capacity of cylinder, under whatever form or arrangement being of course necessary,) would not increase in a higher ratio than that in which the space occupied by the boilers would decrease, less steam being required for the same power; so that the total spaces would remain constant for almost any degree of expansion.

7th. That the steam from its entrance to its exit, would work against a vacuum.

8th. That the difference of pressure at the beginning and end of the stroke would be very considerably less, than in an ordinary engine expanding to the same degree. For example: suppose an ordinary single cylinder, with steam at 45 lbs. expanding nine times, or to 5 lbs.; then, deducting the back pressure, say 3 lbs., we have $45 - 3 = 42$ lbs. at the beginning, and 5 — 3 = 2 lbs. at the end of the stroke, being in the ratio of 21 to 1. If the expansion take place in two stages, as in the arrangements proposed, then for the first stage, we have 45 — 3 = 42 lbs. at the beginning, and 15 — 3 = 12 lbs. at the end of the stroke, being in the ratio of $3\frac{1}{2}$ to 1 only; and for the second stage, (taking place in the opposite cylinder), we have 15 — 3 = 12 lbs., and 5 -- 3 = 2 lbs., being in the ratio of 6 to 1 only. The mean total difference is only $4\frac{3}{4}$ to 1, and this for the same degree of expansion of 9 times.

9th. That the combination of the trunks, not only counteracts the atmospheric pressure on the outer ends of them, which would prevent much expansion, but also save the second connecting rod, and further serves the purpose of guides, and prevents the work of the connecting rod being thrown too severely on the trunk and stuffing box. The combination of the trunks also renders the work done by the out and in strokes (of a horizontal engine), quite equal; the high pressure steam of one cylinder, always acting in conjunction with the low pressure steam of the opposite cylinder. This equality of work in the in and out strokes, cannot well be obtained with a single trunk, except it be carried through the cylinder, as in Messrs. Penn's engine. The only way in which it is ordinarily attempted, is by cutting off the steam later on the trunk side of the piston, by giving the valve less lap on that side. This method of obtaining uniformity is obviously very limited, and not compatable with high degrees of expansion.

10th. That owing to the strength of the various parts of the engine being determined by the pressure of the steam on its first entrance into the cylinder, and this taking place on a comparatively small area, the cost and weight of engines would not increase as on the ordinary construction; and it is presumed that the reduction in the cost of boilers, owing to less steam being required for the same power, would cover an extra cost of engines arising from the greater capacity of cylinder, which is required in order to work more expansively than usual.

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Mr. Allen explained the drawings of his engine, and the mode of its action. He stated that his view had been principally to obtain compactness and sufficient uniformity in the power, combined with a much higher degree of expansion than was at present used in marine engines. There were many practical difficulties in the more extended application of the expansive principle in those engines, on account particularly of the very confined space available for them in the vessels.

The Chairman inquired whether the calculations in the paper had been made only theoretically; he supposed no actual trial of the engine upon the new arrangements proposed had yet taken place.

Mr. Allen explained that the calculations had not been made from actual indicator diagrams, as there had not been an opportunity at present of making a trial of an engine on the proposed plan; but he had made the calculations from carefully constructed diagrams, based on those obtained from the actual working of engines that were so far similar in their action, as to afford safe practical data for the calculations, and full allowance had been made for loss of temperature during expansion of the steam.

The Chairman observed that strong objections were generally entertained by marine engineers to the use of high pressure steam for their engines; greatly on the ground, he believed, of priming, arising probably from the quantity of salt in sea water; but he did not see why these difficulties should not be surmounted.

Mr. Allen stated that in his original paper, which was read at the previous meeting, he had confined his attention to the case of low pressure steam, 35 lbs. total pressure, or 20 lbs. above the atmosphere, as that was the general limit at present in marine engines; but in the present supplementary paper, he had extended the calculations given in the previous one to the case of high pressure steam, in accordance with the desire expressed in the former discussion.

The Chairman inquired what means he proposed for getting over the difficulties which were met with when high pressure steam was used?

Mr. Allen said that the object of his paper was not to investigate any special means of getting over the difficulties accompanying the use of high pressure steam, but merely to show what advantages in point of economy would result, in case some effectual method of overcoming them could be devised.

Mr. Jones observed that facts obtained by actual trial were very essential for confirming theory on such a subject, which was one in which it would be important to have the calculations verified by practical experience; he considered that the calculations in Mr. Allen's paper threw much valuable light on the economy of expansion.

Mr. Hodge thought there would be much liabilty to error in basing calculations on theoretical tables only, not derived from experiments, and in adopting a new design of engine, like that brought forward in connexion with the paper, which had not yet been tried in practice. He disapproved of the short stroke of the engine proposed, since the total effect with the same expansion, that is, cutting off at the same friction of the stroke, was not so good in a short stroke engine as in a long one; but he considered the use of the two cylinders an advantage, on account of the greater uniformity of motion thereby obtained; the latter, however, was not a point of such importance in the propulsion of vessels as in manufactories, since the momentum of the vessel was great, and not easily affected by irregularities in the stroke; but in driving machinery, all variations in the power given out at different portions of the stroke were detrimental. The arrangement of the trunks for shortening up the engine appeared very good, but he thought the cylinders were shorter than was advisable, because less power was obtained out of the steam, by expanding the same volume of steam in a short cylinder than in a long one, as was shown by adding up the ordinates of the expansion curves.

The Chairman inquired whether the form of engines represented was expressly designed for high pressure steam, or whether any other form would be considered preferable in that case.

Mr. Allen replied that the engines were not designed for very high pressure steam, but only for pressures of about 35 to 45 lbs. including the atmosphere; the advantages contemplated in them, were those arising from saving in cost and space occupied, and from allowing the expansion to be carried to a higher degree than usual; large trunks might be objectionable with very high pressure, as the effects of the difference in area would then be rendered more perceptible. The advantage of a long stroke was admitted, but it appeared to be impracticable to obtain a long stroke in a marine engine, with sufficient velocity of revolution of a screw shaft.

The Chairman inquired what was the velocity of revolution proposed with Mr. Allen's engines.

Mr. Allen contemplated working them up to 80 or even 100 revolutions per minute, which was about the speed required for screw shafts; this would give a speed of piston of about 300 ft. or 400 ft. per minute.

Mr. Hodge thought an engine might be driven at a considerably greater speed without difficulty; he had known 600 or 700 ft. per minute attained without difficulty in a long stroke engine, and a good indicator diagram obtained at that speed.

The Chairman remarked that, independently of the difficulty of obtaining a long stroke with a great velocity of the shaft, the section of the vessel would not generally allow of a long stroke sufficiently low down for direct acting horizontal cylinders.

Mr. Hodge said that the balancing of the cylinders by connecting the opposite trunks, appeared to him to be a new and good arrangement; he had not seen it before, and it certainly made the engine very compact; but he did not see that it was accompanied by sufficient advantages to warrant complicating the engine so much as was done by the proposed arrangement.

Mr. Allen explained that it was not necessary to use four cylinders in order that the atmospheric pressure upon the open trunks might be balanced, as this could be done by working the opposite trunk in a condenser; by connecting the opposite trunks, the effects of the variation of the pressure during expansion were diminished, and the atmospheric pressure was entirely neutralized; the four cylinders were, however, desirable where the expansion was carried down to the extent contemplated in the paper—namely, 5 lbs. above a vacuum, as the total power exerted in both directions was thus rendered quite equal. Without the trunk the same amount of expansion could not be obtained without having engines with a long stroke.

Mr. Hodge presumed the extent of expansion was limited only by the power required to overcome the friction of the engine.

Mr. Allen pointed out that the steam might be expanded with advantage to this limit in the engines he had proposed, as when the most expanded steam was acting on the large area piston, there was, in addition to this, when the trunks were coupled, the steam at its highest pressure acting on the small area in the same direction.

Mr. Hodge thought that in horizontal direct acting engines, there was often a great error in not having sufficient length of bearing in the stuffing-boxes, and also in the pistons; it was proved in practice that there was no disadvantage in a long bearing piston if well made. He considered that long-stroke single-cylinder engines were the most economical, and were preferable wherever that form was admissible.

The Chairman remarked that considerable economy was obtainable by a greater degree of expansion, even with the present pressure; but for carrying out the principle thoroughly, it was essential to obtain a considerable increase of pressure, and he thought it was very important for an advance to be made in that direction.

Mr. Allen observed that doubling the size of the cylinders, gave an economy of 29 per cent., with the same pressure as that generally used, 35 to 40 lbs. per inch, which would be a very important improvement on the present working. There were several practical objections to the use of higher pressures of steam, and he was not prepared to recommend much increase at present.

Mr. Hodge inquired what objections were generally advanced to the use of higher pressures; he did not know of any really serious objection, and thought the pressure might be much increased beyond the present average, with important advantage in economy of power.

Mr. Allen said the objections were mainly those arising from minor points of detail, such as priming and leakage of stuffing boxes and boiler joints; these were practical difficulties which might very possibly be got over with further experience.

The Chairman suggested that the general objection to high pressure steam in marine engines was to be attributed to the circumstance of those connected with them not being so much accustomed to high pressure steam; there did not appear to be any sufficient reason why it should not be used as much in marine as in land engines, and particularly in locomotives. He thought the difficulties met with in connexion with the boiler were such as ought to be got over, and would be set aside by engineers accustomed to construct high pressure steam.

Mr. Hodge remarked that marine engineers in this country had mainly confined their attention at present to the low pressure steam; but in the large American steamers on the Hudson, condensing engines were worked with 70 lbs. steam, and a good vacuum of 28 in. was maintained without difficulty with that pressure. Of the difficulties which were urged, priming, he believed, often arose from the steam pipe from the boiler being too small in diameter; he had known cases where this had been the cause. The stuffing boxes ought to give no trouble; they were always made steam tight with high pressure steam, by the Cornish engineers, and in locomotive shops, and if not steam tight in marine engines the workmanship must be defective; he thought the difficulties that had been referred to, were such as might be easily got over.

Mr. Allen observed that some difficulties might be treated as trivial in land engines, which became serious matters in the case of marine engines, from the difference in the circumstances; and in considering the extension of expansion in the latter class of engines, it was necessary to take account even of objections arising merely from minor points of detail. He anticipated that the first step towards improvement in marine engines, would consist in using a higher degree of expansion, with the present pressure of steam, and afterwards making trial of greater pressures. High pressure steam had been very little tried yet in marine engines, and had always been found troublesome; he believed that some engines which had been originally constructed with high pressure steam had been afterwards altered to low pressure.

The Chairman observed that the gun-boats lately made for the Baltic fleet, had steam of from 50 lbs. to 60 lbs. pressure, working without condensing, and he understood they answered very well, and a still higher pressure would probably be tried.

Mr. Shipton suggested that there might be some difficulty with the air-pumps shown in Mr. Allen's engine, from the speed and the position in which they were placed.

Mr Allen remarked that such a difficulty would not affect the principle contained in his paper ; any other form of air-pump might be adopted, if desired ; but he did not think any difficulty was to be anticipated in working the air-pumps even at a higher speed than he had contemplated.

The Chairman said he had recently seen engines that had worked at 130 revolutions per minute, in a vessel that had been out to Africa ; the air-pumps had common leather butterfly valves, very well made, and no difficulty had been experienced from the high speed. He remarked that the great requisite for long voyages, was sufficient surface in the working bearings, to prevent any tendency to heating, in order to allow the vessel to continue running several days without stopping.

Mr. Shipton observed that the trunks shown in Mr. Allen's engine would increase the friction considerably ; he inquired whether any account had been taken of the increased friction in the calculations of the paper.

Mr. Allen replied that the friction was not included in the calculations, in order that they might be as general as possible, instead of being limited to a particular form of engine ; but he did not think that it would materially interfere with the advantages of his proposed engine.

Mr. Shipton observed, that with the present construction of marine engines, the expansion being performed in a single cylinder, must undoubtedly be more limited than in a compound cylinder, such as had been proposed ; otherwise a shock would be caused to the wheels or screw at each stroke by the great inequalities in the driving power ; and consequently, with a single stroke cylinder, it was not advisable to cut-off at a very early point in the stroke.

Mr. Allen said that no great degree of expansion could be obtained in marine engines, except by dividing the process into two steps, as in his proposed engine, by the use of double cylinders : it would be seen, by referring to the tables, that with 120 lbs. of steam, in order to expand down to the lowest useful pressure, in the present engines, it would be necessary to cut off at $\frac{1}{18}$th of the stroke, which was quite impracticable in a single cylinder, on account of the variation in pressure being much too great to be admissible in marine engines ; it was only possible in such a case as the Cornish pumping engines, where great variation in power and velocity of piston was immaterial. But in his proposed engine this high degree of expansion could be obtained practically, by cutting off at $\frac{1}{9}$th in the first cylinder, and doubling the expansion in the second, or at $\frac{1}{6}$th in the first cylinder, and expanding three times in the second.

The Chairman inquired what degree of expansion was adopted in the large engines, making at Soho for the great vessel of the Eastern Steam Navigation Company.

Mr. Garland said he believed it was not intended to work them very expansively, probably cutting off at about $\frac{1}{3}$d of the stroke ; there were four cylinders, 84 in. diameter, with a 4 ft. stroke, and intended to work with about 25 lbs. steam above the atmosphere.

The Chairman suggested that in many cases, the use of 100 lbs. steam without a condenser, might be practically as economical as 50 lbs. steam with a condenser, and would have the advantage in simplicity and compactness.

Mr. Allen thought that condensing was preferable in all cases, and recommended the use of 40 lbs. to 50 lbs., or 60 lbs. steam rather than a higher pressure; the steam to be expanded down to 5 lbs. He showed by a table that when the expansion was carried down to 5 lbs. above a vacuum, there was practically very little margin left for further economy, and the moving power was then very nearly counterbalanced by the friction and the back pressure of the condenser.

The Chairman remarked that their member, Mr. W. Smith, of Dudley, had given a valuable contribution of actual results, of the working of engines in the mining districts, and he hoped some members would take up with the subject in its different branches, to carry out the inquiry that had been so well commenced. The working results of the Cornish engines had been carefully attended to, and constant returns and comparative statements were prepared, with remarkable advantage to the owners, in the practical economy resulting from the plan; and there would doubtless be found greater advantage also in the extension of the plan to other classes of engines. His own conviction was that it would be necessary in many cases of marine engines, particularly in screw-steamers, to use a much higher pressure than was at present employed; the objections of engine makers to attempting the use of high pressure steam, arose from the several practical difficulties that had then to be encountered; but he did not see any reason to doubt that these might be satisfactorily surmounted by further endeavors and improvements in construction or arrangement. The great importance to the employers of steam power of an extension of the expansive principle, in point of economy of power and increase in the cargo-space available in the vessel, had been strikingly shown in the able paper that had been read to the meeting. He expressed a hope that the views advanced in the paper might be carried out practically, and proposed a vote of thanks to Mr. Allen for his paper and tables, which was passed.

D. J. Hoare's Improvements in Screw Propellers.[*]

Sir,—Having been requested by D. J. Hoare, Esq., to forward you a statement of the results I have obtained in investigating his plan of angular propulsion for screw propellers, I have the pleasure of laying before you the following remarks and experiments:—

Mr. Hoare proposes, by arranging the propeller-shaft at an angle of about 30° with the horizon, to obtain an increase of speed—without an increase of power—over that resulting from the horizontal plan, now adopted.

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[*] From the Lond. Artizan, March, 1856.

By analogy, we may infer that some such result would accrue, as a similar principle is involved in towing on canals, in trimming the sails of vessels, in the construction of wind-mills, in the fins and tail of a fish, &c.; but the chief cause of the advantage obtained in the case of the screw by this arrangement, is, that *both blades* would be immersed, and worked against a more dense body of water than could be obtained by the horizontal plan, at present used, as in that arrangement the upper blade works close to the surface of the water, having little or no fulcrum, and leaves the lower one nearly all the work to do. Mr. Hoare, by his angular plan, obviates this difficulty, as my experiments seem to demonstrate.

On thinking over this fact, I am inclined to believe, that, were it mechanically possible, the horizontal screw and driving-shaft would, by virtue of these inequalities of action, have a tendency to assume an angle with the horizon or direction of the vessel, which would be a general resultant of all the operating forces; and that this angle would be one from which the most beneficial results would be obtained in the application of the propelling force.

To test these suggestions, a boat was fitted with clock-work and a propeller, and every care was taken to ensure uniform and reliable result.

On driving this by the horizontal plan, I obtained, as a mean of many trials:—

Distance run.	Time.
40 ft.	20½ seconds.

Power of clock expended.

I took this as a standard of the horizontal plan.

The machinery was then elevated so as to take together, with the driving-shaft and axis of the screw, an angle of 30° with the horizon, the bows, midships, and stem, having the same immersion as in the former experiments. The results obtained were, as a mean:—

Distance run.	Time.
40 ft.	17½ seconds.

Power of clock-work not quite expended.

Now, these results are a proof of the soundness of the principle; but, in these experiments, no just increase of resistance was obtained which would bear a proper ratio to the comparative submersion of the propeller of the model and that of a large vessel. In the experiments this did not exceed an inch, whilst, in practical application, the increased submersion would be some feet, tending, of course, in the latter case, to afford a fuller and more decided result of the conditions of the proposed improvement; in fact, on applying this principle on the large scale, BOTH blades would, at the angle proposed, work against a solid body of water (if we may use the expression), and the resistance to each blade being thus equalized, we should obtain an increase of speed with the exertion of the same power over that from the horizontal plan, just in proportion as this equalization of the action of the blades is carried out. It would also follow that the vibration of the vessel would be lessened, and the situation of the screw would leave the rudder in such a position as to be beyond any influence of the back water.

I am, of course, unprepared to offer any remarks as to the mechanical obstacles which exist in the application of this plan; these, of course, are subjects for the shipbuilder's consideration; but it certainly seems that, by a judicious application of this new plan, combined with recent improvements in the construction of vessels, a great advantage in speed may be obtained, and an economy of working expenses effected.

JAMES WYLDE, Jr.

Royal Polytechnic Institution, February 14, 1856.

For the Journal of the Franklin Institute.

Particulars of the Steamer Guatemala.

Hull built by Wm. H. Webb. Machinery by Fulton Iron Works, New York. Intended service, South American Coast.

HULL.—

Length on deck from fore part of stem to the after part of stern post above the spar deck,		120 feet.	
Breadth of beam amidships,		22 "	
Frames, distance apart *at centres*,			30 inches.
Floor timbers at throats, *molded*, 10 ins., *sided*, 8 to 14 ins.			
Depth of hold,		8 "	
Length of engine and boiler space, including coal bunkers,		44 "	
Draft of water at load line,		5 "	3 "
" " below pressure and revolutions,		5 "	
Area of immersed section at this draft,	90 sq. ft.		
Tonnage,	210.		
Masts and rig—Foretopsail schooner.			

ENGINE.—Vertical beam.

Diameter of cylinder,			30 inches.
Length of stroke,		6 feet.	
Maximum pressure of steam in pounds,	25.		
" revolutions per minute,	22.		

BOILER.—One—Return flued.

Length of boiler,		19 feet.	
Breadth "		7 "	6 inches.
Height " exclusive of steam chimney,		8 "	
Number of furnaces,	2.		
Length of grate bars,		5 "	
Number of flues,	4 above—6 below.		
Internal diameter of upper flues,			16 "
" " lower "			10, 16, and 18½ "
Length of upper flues,		13 feet.	6 "
Heating surface,	607 sq. ft.		
Diameter of smoke pipe,		2 "	8 "
Height " " above grate,		40 "	
Description of coal,	Bituminous.		
Draft,	Natural.		

PADDLE WHEELS.—

Diameter,		18 feet	6 inches
Length of blades,		5 "	
Depth "			15 "
Number "	16.		

Remarks.—Cabin on quarter deck.

C. H. H.

For the Journal of the Franklin Institute.

Particulars of two Iron Screw Propellers, Leopold, and Duc du Brabant, lately built in Antwerp for the Belgian Transatlantic Steamship Line.

Hull built by John Cockerill. Machinery by Cockerill & Co., Antwerp. Intended service, New York to Antwerp.

HULL.—

Length on deck, from fore part of stem to after part of stern post above the spar deck, .	286 feet.	
" at load line, . .	263 "	
Breadth of beam, . . .	38 "	
Depth of hold, . .	27 "	8 inches.

Frames—shape and dimensions, ⅂ L—6 × 3¼ × ¾—5½×3¼ × ⅝ —and 5½ × 3¼ × 9-16—doubling, or edge-frame—4 × 3 × 7-16—14.

Keel—dimensions, 11 by 2½ ins. Stern-post, 11 × 6.

Plates, thickness—27-32 to 15-32.

Keelsons—two, 24 ins. high, ⅝ths thick, with angle iron at edges.

Floors—24 inches high.

Draft of water at load line, . .		20 feet.
Area of immersed section at this draft,	705 sq. ft.	
Tonnage, . . Belgian,	1963.	
English,	1843.	

Masts and rig—barque.

ENGINES—Direct-acting.

Diameter of cylinders, . .		60 inches.
Length of stroke, . . .	4 feet.	

BOILERS.—Four—Tubular.

Description of coal, . Anthracite or Bituminous.

PROPELLERS.—

Diameter of screw, . .	18 feet.

Remarks.—Have five water-tight bulkheads. Have plate stringers upon each deck, 32 inches wide, and ½ an inch thick. Hull, clincher built, rivets, ¾ and 1 inch in diameter, and 3 and 2½ inches apart: double laid.

C. H. H.

The Gums and Resins of Commerce.[*] By P. L. SIMMONDS.

The subject which I have undertaken to open up for discussion this evening, is one embracing so many important articles of commerce, and extending over so wide a field of research, that I can scarcely hope to do common justice to any even of the great classes into which it naturally divides itself—much less to enumerate or particularize one-half of the various new gums and resins which I should desire to bring more prominently into notice. Any one of these gums or resins would have formed ample field for investigation and inquiry of itself, taking it in its several relations of origin, sources of supply, mode of procuring, quantity obtainable, price, chemical composition, and probable utility, as compared with other similar exudations and their commercial uses.

But in taking a rapid survey of the whole group of gummy and resinous exudations, any such close and full description would be utterly impossible—and as it is, I shall have to pass over much of the information I have arranged, leaving it for the quiet perusal and future consideration of those who feel greater interest, in its more extended form in the columns of the Society's *Journal.*

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[*] From the Lond. Journal of the Society of Arts, November, 1855.

In the mode of treating my subject I hesitated at first as to whether it might not be useful to go over each quarter of the globe separately, giving distinct accounts of the gummiferous plants and products of Europe, Africa, Asia, Australia, and America. But on reflection I found that this would entail much repetition, and I am, therefore, necessitated to fall back on the conventional classification usually adopted of true gums, resins, gum resins, oleo resins, and elastic gums, and I hope to be able to furnish something new to our current stock of information under each of these heads.

The importance of this class of commercial products will be better estimated by the statistics I shall be able to furnish of the trade, brought down to within the last year or two.

That there has long been a want of some more detailed information on the gums and resins of commerce will not be denied, for, although much has of late years been done by the several local and metropolitan exhibitions to collect and diffuse correct information, we are still lamentably deficient in details as to the plants that produce very many; and the learned Professor who presides on this occasion, knowing himself how difficult it is to identify plants without the presence of the leaves, barks, and necessary adjuncts, will readily be able to excuse any accidental errors I have fallen into, which his more experienced judgment may be able to correct. Much information respecting the gum-bearing trees of commerce and their products is doubtless to be found scattered through many home and foreign scientific periodicals, but this bears rather on their medicinal value than on their commercial properties and uses in the arts and manufactures, and grave errors continue to be propagated in standard works from day to day; even in a publication of weight and influence like the "*Encyclopædia Britannica*," most of the details in the articles as given in the new edition (as far as it has proceeded,) are nearly reprinted verbatim as issued in its pages some thirty or forty years ago.

There is another work of assumed authority, where one would naturally look for some recent information as to the progress of discovery in new gums and their applications, viz., *Dr. Ure's Dictionary of Arts and Manufactures*, but in the last edition of 1853, the article "Gums" stands verbatim as it did in the edition fifteen years previous, brief and meagre in its character, while that on Resins has merely an addenda of a page to the previous stereotyped matter.

Every one who brings the result of his researches and investigations to bear into the common stock, if he has been diligent and treated the subject fully and fairly, must contribute some few hints that may prove useful, and if I but succeed in doing this, I shall be satisfied.

I must premise that in order to assimilate my information to the erroneous nomenclature of city circles, and commercial lists, I am obliged to depart to some extent from the true scientific definition, and shall speak frequently of many substances as "gums," which are properly gum resins, or pure resins. Were I not to do this, I should confuse many of those whom I see around me, and who have had to buy and sell by names which were erroneously given years ago, before chemical analysis had determined the true composition of many.

It has been well observed by Professor Solly (*Jury Reports*, p. 71), that "a great deal of practical inconvenience and confusion is caused by the indiscriminate manner in which the term *gum* is used in commerce and the arts. It would certainly be an advantage if the distinctions employed in scientific books, were to be generally adopted by merchants and drug-brokers, the term gum being solely applied to those natural vegetable exudations which soften or dissolve in water, and yield a more or less perfect mucilage, but which are wholly insoluble in spirit; the term *resin* being applied to those fusible and combustible vegetable substances which are quite insoluble in water, but which soften and dissolve in ether, the "essential oils," and "spirits of wine," and the term *gum resin* being used to designate those mixtures of gum and resin which are intermediate in properties, and partake of the nature of each, being partially and imperfectly soluble both in water and in alcohol."

Gum, properly so called, is used in large quantities for a number of purposes in the arts. It is generally distinguished into soluble gum, or gum arabic, which readily and perfectly dissolves in water, forming a clear mucilage, and cherry-tree gum, or gum tragacanth, and those difficultly-soluble kinds of gum, which, though they soften easily, do not readily form mucilage. Gum is extensively used in finishing and giving lustre to crapes, silk goods, &c., by calico printers, shoemakers, and in other trades.

As instances of the immense traffic carried on in gums, I may state that one Liverpool firm imported in three years Gum Senegal to the value of £100,000. Gums to the value of 3¼ millions of francs have been shipped annually from Alexandria. The exports from Morocco reach to 250 or 300 tons, and India exports 1500 or 1600 tons.

The GUM ARABIC of commerce is the produce of various species of acacia, which yield this substance in considerable quantities, particularly *A. vera*, a native of Arabia, and of Africa, from Senegal to Egypt, which supplies the finest qualities; *A. Arabica*, a smaller tree, common in India and Africa, which yields part of the Turkey and East India gum; the red pieces constituting the gum gedda and gum babool of commerce.

A. gummifera, a high, thorny tree, found near Mogador, the coast of Guinea, and in Arabia, furnishes what is known as Barbary gum, a darker variety.

A. Senegal yields part of the Senegal gum, the tears of which are usually in larger masses than *arabic*, of a darker color, and more clammy and tenacious. The trade in this variety is chiefly in the hands of the French, and we have imported supplies occasionally from France.

In the Cape colony, gum is collected by the Kaffirs from a species of Acacia closely resembling *A. vera*, which Burchall, in his "Travels into the Interior," calls *A. Capensis*, the *A. karoo*, probably, of Hayne, Nies, and Ebermaier, which is abundant on the banks of the Orange River. It is of a pale yellow color, and is not considered by the dealers so good as that obtained in the more northern parts of Africa.

The ordinary Cape gum of commerce exudes spontaneously from the bark both of the trunk and branches of the thorn tree (*Acacia horrida*, Willd).

A considerable trade was carried on by the Cape colonists a few years ago with Kaffirland for the gum gathered from the Mimosa tree. Wagon-loads were constantly being sent off to Port Elizabeth for shipment to the London market. It was extensively used by calico-printers, calenderers, makers of stationery, and in various industrial arts. The exports have declined from 4876 cwts. in 1849, to 72 cwts. in 1853. The reason for this decline is curious. By mere accident it was discovered that a gum could be manufactured from potatoes or wheat. This article—now called British gum—dextrine, or gum substitute, has superseded the more expensive in almost every department of manufacture and art in which it was used—hence the demand for Kaffir gum is at an end. British gum is found to possess adhesive properties equal to Gum arabic, being less liable to be affected by climate; it is therefore used for postage-stamps, envelopes, &c., as well as in manufactures, and it can be produced for less than one-fourth the cost.

Some fortunes have been made by the discovery, which originated in pure accident, and which is stated to have been made as follows:—

A fire took place in a manufactory of starch from potatoes, near Dublin. The burning building was deluged with water from the fire-engines, and the starch washed about in every direction. A man fell down into the flood of calcined starch and water, but thought no more of it until next morning, when dressing himself he found the legs of his trowsers, sleeves of his coat, pockets, and every other opening firmly obstructed. On examination he thought he had fallen into gum, but on revisiting the scene of the fire he discovered that the properties must be contained in the potato starch, and by a few simple experiments he made a discovery which has resulted in large profits.

According to the statement of Dr. Vaughan, of Aden, the acacia which yields gum arabic is generally a small shrub, of a dry and withered appearance; occasionally, however, it shoots out into a tree of from twenty to thirty feet high. The Somalis, on the north-east coast of Africa, collect the gum during the months of December and January. The process of obtaining it is extremely simple; long incisions are made in the stem and branches, from which the juice flows, and when dry is removed. After the gum of a district has been gathered, it is sewn up in goat skins, and brought on camels to the great Berbera fair, or to some of the smaller settlements on the coast, and thence shipped to Aden and India.

There are three descriptions of the gum, styled severally Felick, Zeila, and Berbera. None of the first-named, which is esteemed the best, finds its way to Aden, the mass being usually bought up by the Banians or Hindoo merchants, and shipped direct to Bombay, where it realizes about 50s. the cwt. The other two named varieties are called after the ports of shipment, and only fetch about half the price of the Felick gum. In 1851, 250 tons of gum arabic passed through the Aden custom-house, the selling price there being about 24s. the cwt.

The local names for the gum arabic, or Summuk, are adad, wadi, and anhokib, of which the anhokib is considered the best. It sells at Bunder

Murrayeh for 1½ dollars per frasila of 20 lbs. The tree is found on the mountain sides, in good red soil, and varies in height from ten to twenty feet. The inferior qualities of gums are sold at a much lower rate.

During the hot season the men and boys are daily employed in collecting gums, which process is carried on as follows:—About the end of February or the beginning of March, the Bedouins visit all the trees in succession, and make a deep incision in each, pulling off a narrow strip of bark for about five inches below the wound. This is left for a month, when a fresh incision is made in the same place, but deeper. A third month elapses, and the operation is again repeated, after which the gum is supposed to have attained a proper degree of consistency. The mountain sides are immediately covered with parties of men and boys, who scrape off the large clear globules into one basket, whilst the inferior quality that has run down the tree is packed separately.

The gum when first taken from the tree is very soft, but hardens quickly. Every fortnight the mountains are visited in this manner, the trees producing large quantities as the season advances, until the middle of September, when the first shower of rain puts a close to the gathering of that year. Large quantities of gum arabic are collected by persons in the employ of the Egyptian government, and brought to Cairo in the caravans to be warehoused. The annual return occasionally reaches to 20,000 packages of 78 lbs. each.

In Morocco, about the middle of November, that is, after a rainy season, which begins in July, the gummy juice exudes spontaneously from the trunk and principal branches of the acacia tree. In about fifteen days it thickens in the furrow, down which it runs, either in vermicular (or worm) shape, or commonly assuming the form of oval and round tears, about the size of a pigeon's egg, of different colors, as they belong to the white or red gum tree. About the middle of December, the Moors encamp on the border of the forest, and the harvest lasts six weeks.

The gum is packed in very large sacks of leather, and brought on the backs of bullocks and camels to certain ports, where it is sold to the French and English merchants. It is highly nutritious. During the time of harvest, of the journey, and of the fair, the Moors of the desert live almost entirely upon it, and experience proves that six ounces of gum are sufficient for the support of a man twenty-four hours.

Gum is largely collected in Central Africa, and sent to the coasts of the Mediterranean and the oceans. Gum arabic and Senegal to the value of £120,000 are exported; other sorts of gums to the value of £12,000, and resins and varnishes to the value of £6000. From Senegambia the quantity of gum exported is given at 25,000 quintals or cwt., of which 9000 go to France, 6000 come to this country, 4000 go to Portugal and the United States, and about 6000 are sent by the caravans of Fezzan and Morocco to other parts of Central Africa.

In the Indian bazaars, the products of a variety of trees are mixed and indiscriminately vended as gum by the native druggists. Among them are gum from the neem, the mango, the babool, (*A. arabica*), *Cassia auriculata*, cotton-tree, and several others. They are much inferior, however, to the gum of the *Acacia vera.*

A large quantity of excellent gum is procured in the East from the wood apple (*Feronia elephantum*), which much resembles gum arabic in its chemical and serviceable proportions, and from its ready solubility it gives the best mucilage for making black ink.

Dr. Wight tells us that good gums are obtained by the natives of Coimbatore from the following plants:—*Aegle marmelos*, *Prosopis spicigera* and *Acacia sundra*; and very fair kinds from *Melia azadirachta*, *Acacia odoratissima Conocarpus latifolia*, *Soymeda febrifuga*, *Odina Wodier* and some others.

The bastard ebony tree of Central India, and also many other of the forest trees which abound there, yield large quantities of rich and valuable gums. Dr. Spry collected as many as fifteen varieties in one locality.

There are more than 130 species of the acacia in Australia, and from them exudes the purest gum arabic. It is so plentiful that at particular periods several pounds may be collected in some places in an hour or two. It possesses all the good properties of the gum from Arabia, and is used successfully for the same purposes in the colony. The *Acacia Senegal* or *Mimosa Senegalensis*, a tree rising fifteen to twenty feet high, affords the SENEGAL GUM of commerce, which does not differ essentially from the gum of *Acacie vera*, except in the shape, and being somewhat less soluble. In 1849 we imported 5696 cwt. of gum senegal direct from Senegambia, and 256 cwt. from Morocco, whence the imports in 1853 reached to 2838 cwt. In 1840, we imported 601 cwt. from the Gambia, and in 1851, 850 cwt. of gum senegal, but none in subsequent years. In the Algerian collection at Paris, mention is made of Mesteba, an indigenous gum of Northern Africa, of which little seems to be known, except that it forms an article of traffic at the markets of the oases in the Algerian desert.

Another white gum, called Aourouar, is also spoken of, and which is said to be shipped to England by the way of Souira; a darker gum yielded by a tree called toleukh, is brought by the caravans from Timbuctoo. These are probably some of the darker and less valuable gum-arabics which come into commerce under the name of Barbary and other gums.

(To be Continued.)

Photography Under Water.[*]

In last week's number of the *Journal of the Society of Arts*, Mr. W. Thompson, of Weymouth, gives an account of the means he adopted for taking a photograph of the bottom of the sea in the Weymouth Bay, at a depth of three fathoms. The camera was placed in a box with a plate-glass front, and a movable shutter to be drawn up when the camera was sunk to the bottom. The camera being focussed in this box on land for objects in the foreground, at about ten yards, or other suitable distance, was let down from a boat to the bottom of the sea, carrying with it the collodion plate, prepared in the ordinary way. When at the bottom the shutter of the box was raised, and the plate was thus exposed for about ten minutes. The box was then drawn into the boat, and the image developed in the usual manner. A view was thus taken of the rocks and weeds lying in the bottom of the bay. Mr. Thompson anticipates that it will be a ready and inexpensive means of arriving at a knowledge of the condition of piers, of bridges, piles, structures, and locks under water.

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[*] From the Lond. Mechanics' Mag., May, 1856.

For the Journal of the Franklin Institute.

Particulars of the Steamer Cuba.

Hull built by Wm. H. Webb. Machinery by Fulton Iron Works, New York. Intended service, Island of Cuba.

Hull.—

Length on deck, from fore part of stem to after part of stern post, above spar deck,		200 feet.	
Breadth of beam at midship section,		30 "	6 inches.
Depth of hold,		13 "	
Length of engine and boiler space, including coal bunkers,		40 "	
Draft of water at load line,		8 "	9 "
" " below pressure and revolutions,		8 "	
Area of immersed midship section at this draft,		222 sq. ft.	
Tonnage,	730.		

Masts and rig—Foretopsail schooner.

Engines.—Vertical beam.

Diameter of cylinder,			60 inches.
Length of stroke,		9 feet.	
Maximum pressure of steam in pounds,	25.		
" revolutions per minute,	17.		

Boilers.—Two—Return flued.

Length of boilers,		23 feet.	
Breadth "		10 "	2 inches.
Height " exclusive of steam chimney,		10 "	
" " inclusive " "		20 "	6 "
Number of furnaces,	2 in each.		
Length of grate bars,		5 "	6 "
Number of flues,	6 above, and 6 below.		
Internal diameter of lower flues, (elliptical),			20 × 14½ "
" " upper "			14½ "
Length of upper flues,		16 feet.	9 "
Heating surface,	2400 sq. ft.		
Diameter of smoke pipe,		5 "	2 "
Height " " above grate,		60 "	
Description of coal,	Bituminous.		
Draft,	Natural.		

Paddle Wheels.—

Diameter,		26 feet.	2 inches.
Length of blades,		8 "	
Depth "		1 "	6 "
Number "	24.		

Remarks.—Floor timbers at throats—*molded*, 10 ins., *sided* 15 inches. Distance of frames apart *at centres,* 30 inches. Poop cabin, and enclosed forecastle.

C. H. H.

For the Journal of the Franklin Institute.

Particulars of the Steamer Alma.

Hull built by John Laird. Machinery by Humphreys, Tenant & Dykes, Liverpool. Intended service, New York to Havre.

HULL.—			
Length on deck,		270 feet.	
Breadth of beam (molded),		36 "	5 inches.
Depth of hold to spar deck,		23 "	
Frames, *shape* ʅ —5 × 4 × ½ and ⅝th ins., and 20 ins. apart.			
Keel, depth 9—thickness 3 inches.			
Contents of bunkers in tons,	600.		
Draft forward and aft,		21 feet.	
Masts, 3—and barque rig.			
ENGINES.—Direct-acting.			
Diameter of cylinders,			64 inches.
Length of stroke,		2 feet.	8 "
Revolutions,	50 to 60.		
BOILERS.—Four—Tubular.			
Load on safety valve in pounds per sq. inch,	20.		
Number of furnaces,	16.		
PROPELLERS.—			
Diameter of screw,		17 feet.	
Pitch "		21 "	
Number of blades,	3.		

Remarks.—Thickness of plates, $\frac{7}{8}$th and $\frac{3}{4}$. Number of bulkheads, 5. Diameter of rivets, $\frac{7}{8}$th and $\frac{3}{4}$. Distances apart, 3 inches. Double riveted. Independent steam, fire, and bilge pump, 1. Has poop deck; is ceiled, and has wrought iron plate stringers on each deck.

C. H. H.

For the Journal of the Franklin Institute.

Extracts from the Diary of CHARLES SCHINZ, *Consulting Chemist of Camden, New Jersey, during a Journey in Europe.*

(Continued from page 63.)

Polytechnic School of Switzerland.

Seeking for improvements in manufacturing industry on the European continent, the stranger is involuntarily made aware, that a new institution for the instruction of practical sciences, has been founded, and calls forth a good deal of attention throughout Europe. The fact, that this institution has been founded by a confederation of twenty-two States, and is supported by them, is indeed the most remarkable of the whole.

In the United States of America, all scientific institutions are founded by the association of scientific men, and most of them are principally supported by the fees paid by the students; on the European continent these institutions are all governed and supported by the Government, and the students pay comparatively but small fees.

The fundamental difference in these institutions in the two countries might be the subject of ample discussion, and much be said pro and contra; but this we leave to others, and attach ourselves to the question:

Which is the best plan for the education and instruction of young men destined to become practical engineers, manufacturers, architects, &c.? and to examine whether the newest creation of this kind, the Polytechnic School of Switzerland, answers well its purpose.

It is an undisputed fact, that among the nations, the Germans are the most scientific and the most learned, but on the other hand, they are also the least practical. Science alone is advanced in Germany, but all other nations know how to make use of it for the advancement of arts and manufactures.

France has the advantage and the talent to pay equal attention to science and to its applications; whereas the English and the Americans plunge into the opposite extreme from that which is prevalent in Germany, in being partial only to what is immediately useful, though the adage: "*Knowledge is power*," appertains to the English language.

Science is knowledge methodically arranged into a system of analogous groups, by which the relations between different facts are made more apparent, and the totality of facts are framed in such a manner, that the student has great facility for retaining them in his memory. But this latter advantage, though most estimated by the Germans, is comparatively of little use to the practical man, and it is for this reason, that those who keep to the other extreme, underrate the usefulness of science generally.

The acquirement of knowledge in a scientific way, has another advantage of much more importance, and this is the practice of the means by which science is elaborated, the way in which collateral facts are linked together, the investigation by which the nature and the causes of facts are established; in one word, the *method*.

Now, the Polytechnic School of Switzerland is a most perfect imitation of any of the German Universities.

There are no less than 25 well paid Professors, 4 Professors' Assistants, and 3 Professors volunteering.

The number of lectures given by those Professors amount to 62, and the number of hours the Professors are teaching weekly together, is 159, besides manipulations, drawing, excursions, making of models, of which there are 18 different kinds, which may occupy at least 108 hours more weekly. Making a total of 267 hours in which the students are taught weekly, and an average of 44½ hours daily.

Of these lectures, 30 are of an entirely scientific character, and these occupy 93 hours weekly, besides 7 lectures where the number of hours is not fixed. 17 lectures are intended to show scientific applications; these occupy 58 hours, plus one lecture without fixed number of hours. And 15 lectures are for teaching different manipulations, &c., supposed to occupy at least 90 hours.

The students to whom so much teaching is offered, are divided into 6 specialities, viz:

1. School for constructors.
2. " civil engineers.
3. " mechanical engineers.
4. " practical chemists.
5. " administrators of forests.
6. " superior natural sciences for the formation of teachers.

The number of years are 2 for the specialities, 1 to 4.
1 for . . 5.
without limits, . 6.

The students of the first speciality have for each year of their studies to attend weekly to 20 hours lectures, and 13 hours manipulations; they are invited to attend to a good many more at their option.

Those wishing to be civil engineers, have to attend to 26 hours lectures, and 13 hours manipulations for the first year, and 20 hours lectures, 13 manipulations in the second year, besides optional courses.

Those to be industrial manufacturers are a little less overcharged by obligatory lectures; they have 18 hours lectures and 11 manipulations in the first year, and 20 hours lectures and 12 hours manipulations in the second, but are expected to fill so much more the auditories of the optional lectures.

Manufacturing chemists have the privilege to be still less charged with learning; they attend to 18 lectures and 19 manipulations in the first year, and to 11 hours lectures and 15 hours manipulations in the second.

I may be pardoned, in giving more details on this class of students, as I feel more competent to be a judge in this speciality.

The lectures of the 1st year consist:

General inorganic and organic chemistry 5 hours weekly.
Chemical manipulations in the laboratary 15 hours.
Zoology 4 hours.
Botany 4 hours.
Geology 4 hours.
Drawing (technical) 4 hours.

Second year.

Technological chemistry 5 hours weekly.
Manipulations in the technological laboratory 9 hours.
Technological physics 4 hours.
" drawing 3 hours.

We will consider the employment of the time of the students hereafter more fully, and I continue to give the number of hours of lectures to which the administrators of forests have to attend; there are 21 hours lectures and an unlimited number of days of excursions and exercises.

The technological university forming the VIth division of students offers 49 different lectures, which are given in about 130 hours, including 12 hours for drawing figures,

12	Landscapes.
30	Making models.

All these lectures are optional for all the students of the school, as are those on English, French, and German literature; some of these lectures are given in French and German at the same time.

Referring to the question we have set down at the beginning of this article, I believe that at first sight we may safely assert that this *is not* the best plan for the education of practical men!

Though the students of the different specialities are not much overcharged with obligatory lectures, the tendency to bring about such a result, is very apparent from the infinity and extreme variety of lectures left optional. A student attending to lectures from 7 in the morning until

8 in the evening, with but a few hours interval, cannot be expected to retain the least part of all he has heard during the day, and he acquires at the utmost a general idea of the different sciences on which he is lectured; such teaching would be of no use at all, if what we have above considered as one of the advantages of the acquirement of science, *method*, was not an integral part of it, and under such circumstances, the wonder is only that the students learn anything!

To illustrate the deficiencies of this new monstrous institution, and to show what is wanted for the education of practical men, we will examine more closely the plan of lectures to which the chemical manufacturers are obliged.

Six hours weekly of general chemistry in the first year, I consider as a very desirable and proportionate teaching.

Botany, Zoology, and elementary Geology, which take 2 hours of each day, are, as I think, an infringement upon the valuable time of young men advanced to seventeen years of age; these subjects might be acquired at an earlier age.

The 15 hours of manipulations in the laboratory, are of course well enough, for a chemist properly is chiefly formed there.

Four hours of Technological Drawing, weekly, and during two years, is either too little or too much. If this teaching is only intended to exercise the faculty of representing the construction of different machines buildings and apparatus artistically, these 300 to 400 hours are too much. If it was intended to exercise the students by this teaching, in putting on paper the solution of problems they have elaborated by their own study, (this is, however, not the case, as there is but one and the same Professor for this part,) the time would be too short, as the manual labor to draw up a single plan with details of a factory for instance, takes at least several days.

Yet the student in this special school has each day to attend 6 hours, of which 3, it is true, are of a nature to relax his mind; but there are some dozens other optional lectures, of which he is expected to avail himself, and supposing he attends only 2 hours more, his time is so taken up by 8 hours daily lectures, that he can scarcely be expected to work much at home, to recapitulate and reconsider what he has heard during the day.

But the most astonishing blunder in the obligatory plan of this speciality, and especially of the first year, is the omission of all mathematical sciences.

What! A chemical manufacturer (and a perfect one too) is not taught any of the rudiments on which are based all the machines he is destined to employ; he is taught botany and zoology, but no physics or mathematics!! He is suffered during the whole first year to ignore the laws of the pressure of the air, the theory of the steam engine, neglecting to use algebra as a tool for all his calculations!

Surely, the fathers of Switzerland must have neglected to consult one single real manufacturer upon the wants of his calling.

These neglects of the first year, are not repaired by the lectures assigned to the studies of the second.

Here we have 5 hours weekly given to the study of technological chemistry, about 200 or 250 hours throughout the year, all by one and the same Professor. What can this poor man do, but read the innumerable books that are annually manufactured, and which describe with more or less accuracy, more or less rationally the arts and manufactures, and thus transmit to his students an immense variety of processes, &c., which he necessarily comprehends himself but indifferently. How could he understand them fully, since he is no practical manufacturer of any kind of fabrics or chemical producer, and even if he was, he would embrace only one of the great variety of specialities.

If a future manufacturer wants to have a general idea of all the arts and manufactures, he may read *Ure's Dictionary*, or *Knapp's Technology*, or any the like, and imbibe in them as many erroneous ideas and half understood processes as if he receives a similar compilation from the desk at school.

The 15 hours weekly of chemical technological manipulations in the laboratory are as the technological drawing, either too much or too little.

They are too much, far too much, if they are intended to exercise the student in the manufacture on a small scale, of such articles as may be of a peculiar interest to him.

But 15 hours spent weekly in the laboratory are far too little, if it was intended to direct the students to undertake any practical investigation by his own study.

In form, educating a practical *chemist*, it is but waste of time to cause him to imitate on a small scale the processes used in manufacturing establishments; he learns nothing by it, as the conditions are entirely different, and depend mostly on principles of economy, which are disregarded in working on a small scale. Pupils that are taught in this way, are fit to imitate a certain manufacturer I have seen lately in the neighborhood of this polytechnic school, who imagines to himself *to manufacture* tartaric acid by evaporating his liquors in a dozen china evaporating dishes, containing each about 10 lbs. of liquor, placed over steam and connected with a very complicated mechanism, which stirs at once the contents of all the 12 dishes!

We have said that one of the principal advantages derived from the study of sciences is the acquirement and the exercise of method. If, now, we have to teach the application of science, I think the chief aim would be to exercise the student in the method to produce such applications; and only then he may be really benefited.

There are so many phenomena and processes in the arts and manufactures which are not yet understood, so many operations susceptible of improvements, that might be made the subject of investigation; and if the station of Professors is considered as it ought in reality be, intended for the advancement of science, Professors for such a school might render great service, not only to the pupils, but to the community at large, by the investigation of such subjects.

But the advancement of knowledge and the exercise of method, are not the only acquirements to be offered to the students of a polytechnic school; the future manufacturer ought to be taught to handle the knowledge he may acquire in the earlier parts of his studies, like a tool, for practical purposes.

We will try to illustrate this. We have spoken above of the manufacture of tartaric acid; this would be a very good subject, for instance, to be given to the students for elaborating a full plan for the establishment of a manufacture of this kind.

Different processes have been proposed and put into practice in the manufacture of this article; each may have its merits under different circumstances, chiefly depending on the price of the different materials according to the locality. Now, let the students discuss and find out which process may deserve the preference under the supposition of given circumstances; let him compare the value of the product with the price of the ingredients which are proposed to be used. Give him the quantity upon which his plan is to be based. Let him calculate the size and the shape of all the vessels to be used for such quantities. Let him calculate what quantity of steam he requires for boiling his materials, for evaporating his liquids, for heating his drying room, for working his steam engine; let him calculate and construct the steam boiler wanted for that purpose. The amount of fuel and its value in money, is also one of the factors he might estimate and set down as a part of his calculation and of his whole plan. The pro and contra for all the means that suggest themselves in elaborating such a practical project might be the subject of ample discussion between the students themselves under the guidance of the Professor.

And finally, the drawing of the whole apparatus, its disposition and distribution, the building for its reception, might be made an exercise for the pupils, by which they might be prepared effectually for their future vocation.

Such exercises would show the students what knowledge they require, how the different sciences in their application work together, and would admonish him to fill up the parts of his knowledge in which he feels deficient.

The second year of studies for the speciality of manufacturing chemist of the Swiss Polytechnic School, comprises a course of lectures of physics applied to the arts, &c., but only 4 hours weekly.

The necessity of such a course is evident, but it might better be placed in the more preparatory first year, and be far more extended and combined with mechanics, &c. The manifold applications of heat, the machines for many purposes, the physical properties of materials, and many other things, should belong to this teaching, and the exercise in drawing might be intimately connected with and guided by this part of teaching. Many subjects for elaboration similar to those of a manufacture of tartaric acid, might employ the activity of the students, and be made a preliminary exercise, preparing him for such kinds as above described.

Division of labor, at the present day, is one of the chief conditions in manufacturing industry for cheap production; division of teaching is also very desirable and useful for the teaching of special sciences; but where the object is the exercise of method for the application of science, the division of lectures among many Professors must necessarily have an unsatisfactory result, and must lead to the deficiency observed among the Germans, who, like beasts of burden, carry with them a great amount of knowledge, but are unable to bring forth any useful results from it.

Among the institutions purposing the education of young men for a certain profession, there are none as perfect as those for builders and architects. The amount of knowledge required for a thorough-bred architect is certainly not inferior to that for any of the other technical professions, but it is more easy to find teachers of a practical turn, who elaborate methodically each plan of the constructions they have to propose. In manufacturing industry, the method of investigation is much more specific for each peculiar case, and men who perform such arts with success are more frequently men of genius, who, without any method, by a certain tact find out the best means without being able to give and explain the principles upon which they act.

If we admit this, then indeed a university of technological sciences, where the students acquire only knowledge of properties and facts, is the only thing that can be offered for the education of young men, and it must be left to their own genius to make use of this knowledge as well as they may and can when they come into practical life. This is the prevalent mode of education in Germany, but experience shows that its results are not very satisfactory.

It has to be tried, and has been tried successfully in France, to find such men of genius who make it their study to imitate the architect, to produce general *methods* for the investigation of such subjects as belong to manufacturing industry. The names of Payen, Persoz, Leblanc, Armangaud, Peclet, Chieveul, were successful antecedents; and the schools where they have taught, have sent forth such pupils as have been of immense service to all the branches of arts and manufacturing industry. Those men have understood the real wants for the education of practical men; we mean those men who unite in themselves a stock of knowledge and the means to make use of it for the material benefit of the whole nation.

A whole book might be written on this subject, but I trust that the above given considerations and specifications, may sufficiently illustrate the principles which ought to guide the construction of polytechnic schools.

The Telegraph in Switzerland.

The telegraph in Switzerland is an institution that is much more successful than its polytechnic school promises to be. If even I felt competent to describe its perfect technical operation, I should not enlarge on this subject, as it is well known in America; but the liberality of the institution and the pecuniary results obtained from it, are worth mentioning. 25 words or less are uniformly paid by 1 franc, ($17\frac{3}{4}$ cents,) whether the message has to go 150 or only 2 miles. The public are induced by this cheapness to use the telegraph as freely as they use the mails, and the result is that the administration of the telegraph, which is under the control of government, has a surplus of cash in its coffers.

Almost every small town of 3000 to 5000 inhabitants has its telegraph office; of course, it would not pay to have a special telegraph office in each of these places, and therefore, the officers appointed by the central post-office are at the same time officers of the telegraph, though their duties concerning the expedition of letters often prevent them from attending to the telegraph; but as the administration of the telegraph pays them partly, according to the amount of messages received at their offices, they have to provide for the performance of these duties; they, of course, seek to supply them by the cheapest clerks; they can have and find them in their wives, sisters, or daughters, and I have been assured by one of the superior officers of the telegraph, that at those offices where ladies are the performers, the business is generally done more perfectly than where men are exclusively appointed to attend.

Illuminating Gas from Wood.

Illuminating gas from wood is being now introduced into Zurich, and I had the opportunity to be presented to the engineer who is building these works, and to gather from him the astonishing improvements that have been lately introduced in the manufacturing of illuminating gas from that material.

It appears that the first gas produced at Munich had an illuminating power of 12·92 standard wax candles for a consumption of 4½ cubic feet. The works of Heilbronn furnish now a gas with an illuminating power of 13·5 wax candles for 4½ cubic feet.

The works of Rohrbach, in Austria, furnish a gas of 16 wax candles for 4½ cubic feet, and at the present day, M. Riedinger, the chief engineer, furnishes wood gas that has the power of 17 wax candles with a consumption of 4½ cubic feet.

Thus the illuminating power of that description of gas has improved 22·8 per cent.

Compared to the best kinds of coal gas, 6 cubic feet of the latter produce no more light than 5 cubic feet of wood gas.

The analysis of Wigan Cannel coal gas, and wood gas, gives the following results:

	Coal Gas.	Wood Gas.
Bi-carburetted hydrogen,	10·55	10·57
Carburet of hydrogen,	27·20	33·76
Free hydrogen,	47·39	18·05
Oxide of carbon,	14·86	27·62
	100·00	100·00

The difference in the composition of these gases, must be the cause of the greater illuminating power of the wood gas, though this single fact does not give a satisfactory explanation.

The inventors of the wood gas are about to apply for patents in America, and therefore, I am not at present at liberty to describe the means by which they have improved so much their process.

Sulphate of Alumina.

Sulphate of Alumina is an article of chemical manufacture which appears to be well appreciated by paper manufacturers, for the decomposition of the resinous soap for the purpose of sizing paper. I believe this article is not yet manufactured nor used in the United States, but I believe it may be highly recommended, as being cheaper than alum and of more richness than the latter in alumina, so that the paper receives more of it, an advantage which may also bear upon the quality of the paper.

Window Glass.

At the glass works in Bavaria, a new kind of glass panes are made; they are convex, as —⌒—, and are made by means of cast iron moulds. After the glass is rolled into straight panes, they are, while yet soft, placed on these moulds, where they take the shape in which they are allowed to cool.

These convex panes give to the windows to which they are applied a most agreeable appearance, as they disperse the light in all directions, and it may be said that these curved glass panes are rather an improvement in architecture than of the art of manufacturing window glass.

Elasticity of Vulcanized Caoutchouc.

M. P. Boileau has made a series of experiments upon the elasticity of vulcanized caoutchouc, which he reported to the Academy of Sciences, of Paris. The material was used in the form of a pile of disks separated by other disks of metal, as it is used for springs for railroad cars, &c.

The disks were eight in number, and were compressed progressively by a lever loaded gradually with different weights; then the lever was gradually unloaded. The compression corresponding to different loads, from 166 kil. to 806 kil. for the eight disks, that is, about from 2967 to 14,404 kil. per square centimetre, were observed and recorded in a table. In order to determine the law of the variation of compressibility, these results were projected on a large scale in the form of a curve, having the load per sq. centimetre for abscissas, and the corresponding compressions for ordinates; then from this sum were taken the depressions due to the increase of ½ kil. per sq. centimetre. The results of this operation compose the following table.

Pressures on square centimetre.	Increase of compression.	Pressures on square centimetre.	Increase of compression.
kil.	mm.	kil.	mm.
2·0	0·60	8·5	0·63
2·5	0·64	9·0	0·60
3·0	0·70	9·5	0·57
3·5	0·85	10·0	0·49
4·0	0·99	10·5	0·32
4·5	1·05	11·0	0·20
5·0	1·04	11·5	0·15
5·5	0·98	12·0	0·14
6·0	0·90	12·5	0·13
6·5	0·80	13·0	0·12
7·0	0·73	13·5	0·11
7·5	0·70	14·0	0·10
8·0	0·66		

The curve shows at first sight that the law is not simple nor even constant. The principal fact is a maximum of compressibility which is produced by a load of 4·7 kil. per sq. centimetre; near this point of maximum the compressibilities increase and decrease rapidly. From the load of 11·5 kil. up to that at which the material undergoes permanent change of form, the decrease of compressibility is very small, but this period is preceded by one in which the contrary takes place to that within the limit of the experiments, and probably from the lightest loads up to those which crush the material, the compressibility of disks of caoutchouc passes through a succession of periods of alternate slow and rapid compressions.

The author thinks that this complication of phenomena must be due in part to the molecular constitution of the substance considered, and that the caloric developed by the compression is concerned in it.

In regard to reducing the pressure, when starting from 806 kil., the elastic column is slowly and progressively discharged; it did not take exactly the weights corresponding to the same pressures during the period of compression, but it returned to its original height when all the weights were removed. This latter circumstance proves that the elasticity of the caoutchouc had undergone no change.

In using springs, it is important to limit the pressures so as not to change their elasticity. In regard to this condition, the preceding results show that the pressure 14·404 kil. per sq. centimetre was not too great, but in another series of experiments the load being increased to 18·12 kil., the permanent change of the disks became very sensible, not only by their diminution in thickness, but also by the upper and lower edges changing to oblique and slightly curved surfaces. When the changes are sudden, or by blows frequently reiterated, the mean effect of the blow should not exceed 10 kil. per sq. centimetre.—(*L'Institut*, 28th May, 1856, p. 190.)

A new—old Invention.

In *Poggendorff's Annalen*, Tome xcv. p., 607, M. Du Bois Reymond proposes to enable the galvanometer needle to be read more easily and accurately by mounting a mirror upon its axis, and measuring the deflection of a ray of light, upon a screen at any distance. This is the principle used by Saxton in his pyrometer fully twenty years ago ; and since applied by Gauss & Weber, and others, for reading the deflection of magnetometers. It is quite fashionable for European scientific men to ignore American inventions, but they should know, at least, what their own eminent men have done. Ed.

New modification of the Galvanometer Coil.

M. Bonelli proposes a modification of the galvanometer coil, by which he hopes to obtain greater delicacy by bringing the conductors closer together, and greater economy by the cheapness of the material used, and the simplicity of the construction. His proposition is to rule a number of parallel metallic lines upon paper, as close together as possible. Then, if the band be so wrapped that all the left-hand ends of the lines shall be connected together and with one pole of the battery, while all the right-hand ends be likewise connected, and with the other pole, the coil will be equivalent to the one made of the ordinary wires, whose section is equal to the sum of the sections of the lines, and whose length is equal to the length of any one line : but if the band be so wrapped that the right-hand end of the first line is in connexion with the left-hand end of the second and so on ; the poles of the battery being connected respectively with the left-hand end of the first, and the right-hand end of the last ; then the arrangement will be equivalent to a coil of wire whose cross-section is equal to that of one of the lines, and whose length is equal to the sum of the lengths of all the lines.—(*Comptes Rendus de l'Academie des Sciences*, (*Paris*,) 12*th May*, 1856. This proposition is a development of Prof. Henry's very successful suggestion of substituting flat metallic ribbons in place of wire in the coil. The indefinite thickness of the lines, will apparently render it useful only in cases where the wire of the galvanometer should be very fine. Ed.

Heating Cold Water by friction.

Our readers may have had their attention attracted by the wonderful accounts, in our would-be scientific papers, of a machine exhibited at the French Exhibition, by which water was to be heated, and steam of any power raised, by the heat generated by friction—the friction being produced by forces otherwise unavailable. It threatened to be a second Caloric Engine, but the Committee to which the French Academy of Sciences referred it, (Morin reporter,) have shown in the session of 21st April, that for raising steam, it is by far the most costly means yet proposed for getting power; and that cooking by it is impossible, since, in the machine arranged for that purpose, the force of eight men exerted for 4½ hours was barely able to raise 5 litres (1⅓ galls.,) from 42° to 169° Fahr. On another trial, eight men in eight hours raised 2½ gals. water from 39° to 156° Fahr. The highest of these temperatures is insufficient for cooking purposes. Are there not yet some other similar inventions for the Academy? Ed.

On the Crystallization of Platinum from Fusion.[*]

By J. W. Mallet, Ph. D.

Having recently prepared some bichloride of platinum as a re-agent by dissolving scraps of platinum foil, wire, &c. in nitro-muriatic acid, I poured off the yet strongly acid solution, before the whole of the metal had disappeared, and washed and dried the remaining scraps. Among them there were five or six small beads of platinum, which had been melted off from the end of a wire (of about one-fortieth of an inch in diameter) by the oxyhydrogen blow-pipe flame. I was surprised to observe that these globules, which were spherical, and quite smooth and brilliant before the acid had acted upon them, afterwards presented distinct traces of crystallization, resembling to the eye the little polyhedral beads of phosphate of lead, which are obtained by fusing that salt before the blowpipe.

Some of the minute faces were plane or nearly so, but most of them were slightly rounded, like those of many crystals of diamond. They presented for the most part, the peculiar lustre of metal, with very minute striæ on the surface, but some of the faces were brilliant.

The prevailing form seemed to be the tetrakis-hexahedron, of which there was one very distinct example; and besides this, faces of the octahedron, and *perhaps* of the cube, with truncated angles—combinations of the cube with the octahedron— were recognisable on other beads.

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[*] From the Lond. Chem. Gaz., No. 317.

Some of the globules were apparently *groups* of minute crystals, while one or two seemed to be distinct individuals.

The weight of the largest was not more than 0·11 grm.

The crystalline faces were no doubt rendered visible by the *dissecting* action of the acid, in the same way that the structure of a lump of alum may, as is well known, be brought out by partial solution in water, the chemical homogeneous mass, offering at different points a greater or less resistance to the solvent, dependent upon the positions of these points with reference to the crystalline axes, just as the actual hardness of resistance offered to mechanical abrasion differs at different parts of the surface of a crystal.

The assumption of distinct crystalline structure by platinum, under the circumstances mentioned, is remarkable from the extremely high melting point of the metal, the small quantity fused in each bead, and therefore the very short time in which each must have passed from the liquid to the solid state.—*Silliman's Journal*, November, 1855.

For the Journal of the Franklin Institute.

Particulars of the Steamer Barcelona.

Hull built by John Laird. Machinery by Fawcett, Preston & Co., Liverpool. Intended service, New York to Havre.

HULL.—			
Length on deck,		265 feet.	
Breadth of beam (molded),		36 "	3 inches.
Depth of hold, to spar deck,		25 "	9 "
Draft,		21 "	
Tonnage,	1620.		
Contents of bunkers in tons,	600.		
Masts, three, and barque rig.			
Frames, *shape* Z —5 × 4 × ½ and ⅝—and 20 ins. apart.			
Keel, *depth*, 9 ins.; dimensions, 3 inches.			
ENGINES.—Horizontal direct-acting.			
Diameter of cylinders,			56 inches.
Length of stroke,		2 feet.	6 "
Revolutions,	50 to 60.		
BOILERS.—Four—Tubular.			
Breadth of boilers,		13 feet.	6 inches.
Load on safety valve in pounds per sq. in.,	20.		
Number of furnaces,	16.		
Length of grate bars,		5 "	6 "
Number of tubes.	90 in each furnace.		
Internal diameter of tubes,			2½ "
Length of tubes,		5 "	3½ "
PROPELLER.—			
Diameter of screw,		16 feet.	
Pitch,		23 "	
Number of blades,	3.		

Remarks.—Thickness of plates, ⅞ and ¾. Number of bulkheads, five. Diameter of rivets, ⅞ and ¾. Distances apart, 3 inches. Independent steam, fire, and bilge pump, 1. Has poop deck; is ceiled, and has wrought iron plate stringers on each deck.

C. H. H.

A Manufactory of Ultramarine at Nuremberg.[*]

The manufactory belonging to Messrs. Zeltner & Heyne has acquired a European reputation, and sends its produce to all parts of the globe. Its exterior aspect is somewhat imposing, the whole being surrounded by a wall, and one of the buildings looks rather like a fortress, the entire space occupying an area of seven Bavarian acres (*Morgen*). The central building consists of a polygon of twenty-four sides, with ninety-six furnaces, arranged in twelve compartments with as many high chimneys. Thence issue twelve branches of rails to all parts of the manufactory, being provided at the intersecting points with turning platforms. From the upper stories similar rails of wood are laid; the iron rails being 4500 feet long, the wooden ones a trifle less. If we enter the polygon, which has a diameter of 136 feet, and is surrounded by buildings 300 feet long, and two stories high,—the dim of twilight gives the idea of being in the pit of a mine. All these buildings are vaulted and bomb-proof. The departments of this manufactory are manifold. In the middle is a building for mechanical contrivances, with two steam engines; to the east the above polygon; towards the west a high-pressure engine, with a mill and a washing apparatus. The mills have twenty-eight troughs, and are mostly of cast iron; of the two stores one is 300 feet long, and this alone can hold 3000 to 4000 cwts. of ultramarine. A swinging rail transfers the colors from one end of the building to the other. Covered passages connect the single buildings, and there are seven large roads and six courts, presenting everywhere a fine perspective. Towards the west is a long row of drying-houses, in which a constant tropical heat is to be maintained, so that winter loses its power in all the vicinity. The merit of the discovery of artificial ultramarine belongs to Professor Gmelin, who died in scanty circumstances. This manufactory arose in 1839, and the proprietors preserve yet the weather-boarded shed in which they began business. The manufactory employs 200 workmen, of whom 180 are married. They have established a sick fund, and a pension fund for widows, orphans, and invalids, as well as a singing chorus. The best blue artificial ultramarine has to pass eighty different processes until it is ready for use, and is now applied to the coloring of cotton and wool-stuffs, tapestry, paper, sealing-wax, &c.; besides its purely artistic use.

Paper from Jute.[†]

Mr. M. D. L. Nash, writing from Chester, makes the following suggestion:—"Jute is one of the most remarkable articles of commerce in Liverpool. It is an East India grass in bales, of which (according to Braithwaite Pool's valuable work on the commerce of Liverpool), there are nearly 100,000 bales annually, the average selling price £20 per bale. This grass is sent to Dundee and the north, and the fibre so resembles caterpillar's thread, that it is used to adulterate silk. It is made into coverings called "baggings," to serve as wrappers for the American cotton. It is sent back to Liverpool so manufactured, and exported to South America, where it is filled with the cotton, sent back in cotton bales to Liverpool, thence to Manchester, and finally finds its way to the paper makers. Now there is no reason why an ample supply should not be had for paper; and perhaps a notice of the matter may obtain the attention of the scientific."—*Liverpool Northern Times.*

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[*] From the Lond. Builder, No. 684.

[†] From Herapath's Journal, No. 875.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, July 17, 1856.

Prof. B. Howard Rand, President, pro tem., in the chair.

Robert C. Cornelius, Recording Secretary, pro tem.

The minutes of the last meeting were read and approved.

A letter was read from the Regents of the University of New York.

Donations to the Library were received from the Royal Geographical Society; The Society of Arts, &c.; The Statistical Society, and the Commissioners of Patents, London; La Societie d'Encouragement Pour l'Industrie Nationale, Paris; Hon. Job R. Tyson, U. S. Congress; The University of Michigan, at Detroit, Mich.; The Maryland Institute, Baltimore, Md.; Thomas U. Walter, Esq., Washington, D. C.; Prof. John F. Frazer; The Mercantile Library Company; Mr. Philip Price; Mr. John W. Nystrom, and Mr. T. E. Chapman, Philadelphia.

Donations to the Cabinet of Models from Geo. M. Ramsay, Esq., City of New York.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer's statement of the receipts and payments for the month of June was read.

The Board of Managers and Standing Committees reported their minutes.

Candidates for membership in the Institute (4) were proposed, and the candidates proposed at the last meeting (4) were duly elected.

W. Jones presented to the notice of the members, a very simple and apparently efficient plan to regulate the temperature of apartments warmed by steam passing through tubes. It is termed by the inventor, Mr. R. Cornelius, a "Steam regulating Valve."

It consists of a conical valve and seat, which opens or closes to permit the escape of the water of condensation, motion being given by the expansion and contraction in the length of that part of the tubes containing the valve and seat; the tubes being attached to the walls by brackets, having an adjusting screw, and placed ten or twelve feet apart. The plan was tried last winter in the manufactory of the inventor, and worked to his entire satisfaction. It has been submitted to the Committee on Science and the Arts, and a more detailed description will be found in the *Journal* when that body shall report upon it.

Mr. S. E. Winslow exhibited and explained a plan invented by him to prevent the explosion of lamps or cans containing burning fluid. Several experiments were tried by him to show the usefulness of the invention; one was, to explode a portion of the fluid in a can, and then attach his apparatus to the spout of the can and hold it to the flame of a candle without any explosion taking place—and to fill a burning lamp with fluid from a can with the safety apparatus attached, without explosion or danger of one. Most persons are aware of the danger of this, and of the loss of life that occurs from explosion in filling lighted lamps. The plan of Mr. Winslow will prevent this, as Davy's lamp did the ignition of fire damp, the operations being similar. Mr. Winslow also has submitted his improvement to the Committee on Science and the Arts, and their report will no doubt be published in the *Journal.*

COMMITTEE ON SCIENCE AND THE ARTS.

Proceedings of Stated Meeting, July 10th, 1856.

Prof. John C. Cresson, Chairman, presiding.

Reports read the first time and laid on the table:

No. 691.—On J. W. Hoards' Gas Regulator.
" 692.— " Aaron Robert's Telescopic Fire Apparatus.
" 696.— " Wm. F. Brown's Seamless Tubes and Apparatus for manufacturing the same.
" 697.— " Jacob Frick's Improvement in Steam Engines.

Reports passed second reading and adopted:

" 677.— " Ignition of Saw-Dust, at a low temperature, in the Factory of Messrs. Jos. S. Elkinton & Son.
" 677 was referred to the Committee on Publications.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on a Case of Apparently Spontaneous Ignition of Saw-Dust.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "a Case of apparently Spontaneous Ignition of Saw-Dust, occurring in the factory of Mr. Jos S. Elkinton & Son—Reports:

That Mr. E. states that he "observed a mass of saw-dust, which had been confined for about nine months by a wooden box around one of Wilson's Patent Tanks for rendering grease, heated to a red heat like a mass of live coal, apparently ready to burst into flame although at a distance of forty feet from any fire.

The tank is a cylindrical vessel of boiler iron, about 10 feet high and 4 feet in diameter; it is made steam tight; having openings which can be closed at pleasure near the top and bottom for the admission and discharge of fatty matters to be melted. Heat is applied by introducing steam through a pipe opening into the bottom of the tank; the pressure used is about 50 lbs. to the square inch (=280° Fah.)

The heat applied from six to nine hours in succession, and the apparatus used two or three times a week.

When the fire was first discovered an inch board forming part of the bottom of the box had been burned through.

The fire appears to have begun near the bottom of the box, but in several other places where the saw-dust touched the sides of the tank, it was charred.

Mr. Elkinton attributes the entire destruction of his father's factory in 1853, to a similar accident.

The Committee can assign one of two causes for the occurrence.

It is well known that porous materials, when greased, especially if slightly dampened, will take fire from the heat developed by the oxidation of the grease; this will take place more readily at high than at lower temperatures. Had the tank been leaky, this might have been assigned as the cause. The Committee believe, however, that such was not the case, and that another cause must be sought.

It is also a fact, first it is believed distinctly pointed out by Mr. Braidwood, Chief of the London Fire Brigade, that wood long exposed to temperatures but little above that of boiling water, will become, after a time, charred and will actually inflame. Numerous instances of accidental fires thus caused have been adduced. The following, however, given by Mr. William Birking, in his "*Guide to the proper regulation of Buildings in Towns,*" *&c.*, bears most directly upon the case before the Committee.

Day & Martin's Blacking Factory, in High Holborn, was heated by hot water circulating in tubes, the temperature never much exceeding 300° F. In December, 1848, the wooden casing and other woodwork about the upright pipes were found to be on fire; and on examination it was found that wherever the pipes touched the floor, the boards were charred.

There can be but little doubt that the saw-dust in the case before the Committee, exposed at intervals for nine months to a temperature of about 280° F., became charred by the gradual distillation of the water and volatile matters of the wood. Charcoal thus formed at a low temperature is much more inflammable and hygrometric than that made at higher temperatures.

Whether such charcoal will absolutely inflame under 300°, the Committee is not able to say; it is possible that the rapid absorption of large quantities of oxygen by it, would produce sufficient elevation of temperature to cause actual combustion. The fact is however established, that such combustion will occur under the circumstances indicated; and is of importance from the liability to recurrence of the accident under like circumstances; as in the cases of joists running near flues or through hot air chambers; woodwork on steamboats near the boiler, steam drum, or smoke stack; jacketing of boilers in ordinary situations, &c.

The Committee believe that the attention of builders and others should be called to the fact, with the object of avoiding the risk and thus diminishing the causes of fire, already too numerous.

By order of the Committee,

Philadelphia, July 10th, 1856. Wm. Hamilton, *Actuary.*

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

SEPTEMBER, 1856.

CIVIL ENGINEERING.

*On the Improvement of Railway Locomotive Stock and the reduction of the Working Expenses.** By Daniel Kinnear Clark, Assoc. Inst. Civ. Eng.

[Read before the Insitution of Civil Engineers, May 20th, 1856.]

It was stated that the design of the paper was to discuss the locomotive engine physiologically; to consider some departments of practice which appeared to be in a transition state; to endeavor to indicate how far, in some respects, the locomotive, even in its present advanced state of existence, was susceptible of improvement, and to form some estimate of the pecuniary advantages thus derivable. The three elements of the locomotive—the boiler, the engine, and the carriage—were considered successively.

With respect to the boiler, the fuels in use in this country were stated to be coke and coal. The author had in a previous paper, shown by mechanical analysis, that the combustion of coke in the locomotive was practically complete; and he adduced in corroboration, the results of a subsequent chemical analysis of the gases of combustion, by M. Ebelmen, in the engines of the Paris and Lyons Railway. In the combustion of coal, which consisted chiefly of carbon and hydrogen, the production of smoke was ascribed to the presence of the hydrogen, which had a stronger affinity for oxygen than carbon had, and thus precipitated the carbon particles raised in union with it in the form of smoke; and it was maintained that, to effect the consumption or prevention of smoke, two conditions of supply must be observed,—a sufficiency of oxygen, and a sufficiently high temperature. For these conditions it was argued that, in locomotive practice, strength of draft, and a means of equalizing the temperature were necessary to neutralize the evil of intermittent firing, and the unavoidable fluctuations of temperature.

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* From Newton's Lond. Journ., July, 1856.

The author adduced in evidence, the results of trials made by him in 1850-51, and by Messrs. Woods and Marshall in 1854, which showed that in the prevailing type of boilers, the evaporative power of good coal and good coke were as two to three: coal doing mechanically just two-thirds of the duty of coke. He proceeded to give an account of recent trials made by him in the beginning of this year with the "Canute," on the London and South Western Railway, one of Beattie's passenger-locomotives, planned expressly for the combustion of coal, and the heating of the feed-water. A pile of fire-bricks, through which the products of combustion must pass, was deposited in a combustion chamber, joining the fire box and the tubes, to act as an equalizer of temperature. The hind compartment of the fire-box also was arched over with fire-bricks. The heating apparatus was in two parts,—the condenser outside, which acted by throwing the feed-water in jets amongst the exhaust steam,—and the superheater inside the smoke-box, through which the feed-water was also passed just before entering the boiler. The cylinders were 15 inches diameter, with a length of stroke of 21 inches,—driving wheels 6½ feet,—fire grate area 16 square feet,—heating surface 769 square feet,—and the weight of bricks was 5¾ cwt. It was found that in the "Canute," the prevention of smoke was completely attained with ordinary care and attention; that the evaporative power of the coal was materially improved; and that the heating apparatus was decidedly beneficial. With the regular express trains the following results were obtained: average express trains 10½ carriages estimated at 66 tons weight; average speed, excluding stoppages, 34 miles per hour; water evaporated on duty, 82 cubic feet per hour of the time the steam was on the piston; corresponding consumption of coal, 547 lbs. per hour, and 15 lbs. per train mile; water evaporated per pound of coal, 9·35 lbs.; average temperature of feed-water, 187° Fahr. Special train of 28 carriages weighing 203 tons: average speed, 30¾ miles per hour; water evaporated as before, 130 cubic feet per hour; coal per hour, 915 lbs., and per train mile 28¾ lbs.; water evaporated per pound of coal, 8·87 lbs., temperature of feed-water 212° Fahr. It was argued that, on Beattie's system, an economy of 36 per cent. of coal was effected in comparison with ordinary engines burning coal; and that this system was on a footing of equality with coke-burning engines, in evaporative efficiency of fuel, weight for weight.

The water supplied to locomotive boilers was stated to be generally impure, mechanically, or chemically, and to affect very injuriously the durability of the engine—reducing in one case the durability of the tubes from eight or nine years with soft water, to three years with hard water. The loss by priming with bad water was shown to be considerable. It was concluded that the water supplied to locomotives should be previously purified, chemically and mechanically, in large tanks or reservoirs.

With respect to the engine proper, the author maintained that the link motion was a sufficient and satisfactory expansion gear; that its merits were not appreciated; and that in the ordinary practice of expansive working in locomotives, the steam was not cut off earlier than at 40 to 50 per cent. of the stroke; but that, with proper arrangements, it might be cut off at one-fifth. He argued also that the steam should be superheated, and the cylinders perfectly protected; and that the slide valves should be balanced.

With respect to the carriage, a *resumé* of the early and current practice of engine boilers was given, from which it appeared that the system of six wheels, with central drivers, was the prevailing practice. It was argued that this system was best adapted to secure the main objects in the carriage,—a sufficiency of driving weight, and free and steady running at high speed; with the important proviso, that the revolving and reciprocating masses of the pistons and cranks and their connexions, should be balanced in the wheels. Evidence was adduced in proof of the economy of fuel effected by a correct equilibration of the engine.

In conclusion, an estimate was formed of the economy of working expenses due to the improvements described on the assumption,—first, that the consumption of fuel was an index to the working charges generally of the locomotive stock; second,—that the average cost per ton of coal and coke, for locomotive purposes, were as two to three generally; and third,—that the feed-water supplied to boilers was generally impure.

The following was an abstract of the successive items of economy of working charges, separately estimated :—

By the successful substitution of coal for coke, .	33	per cent.
By efficiently heating the feed-water, . . .	15	"
By the use of pure feed-water, ...	10	"
By protecting the cylinders, and superheating the steam,	10	"
By increased expansive working, . . .	25	"
By the correct equilibration of the engine, . . .	10	"

The gross resulting economy would then be represented, not, of course, by the direct sum of these per centages, but by the result of the successive reductions obtainable by their successive application. Thus, after making the first deduction of 33 per cent., there would remain a balance of 67 per cent. to be operated upon for the second deduction, which was 15 per cent.; but 15 per cent. of 67 was equivalent to 10 per cent of the original quantity, and would leave 67—10=57 per cent.: the third deduction to be made was 10 per cent. of 57, or 5·7 per cent. of the original, leaving 51·3 per cent., as the balance to be operated upon for the next deduction. Continuing the operation in this manner the gross resulting economy would amount to about 70 per cent. of the existing average working charges. Allowing for contingencies in the estimate, 50 per cent. was adopted by the author as the probable average saving that might be effected in the consumption of fuel, and generally in the working charges of the locomotive stock of the railways of the United Kingdom.

The average apportionment of the receipts on the Railways of this country, was stated to be as follows, on the authority of Mr. Chattaway:—

Working charges,	46½ per cent.
Interest on guarantied capital,	28½ "
Dividends in respect of ordinary shares,	25 "
Gross receipts,	100

Also, that the average cost of locomotive power was 29·3 per cent of the receipts; consequently, the saving estimated by the author, would be one-half of this, or 15 per cent. of the receipts, and would raise the available dividends from 25 to 40 per cent. of the receipts; or from the average, on ordinary share capital, stated by Mr. Chattaway, as 3·14 per cent., to a dividend of 5 per cent. per annum.

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*On Wood Bearings for Screw Propeller Shafts.** By Mr. John Penn, of London.

[Paper read before the Institution of Mechanical Engineers, January 30, 1856.]

In the bearings of the shafts of screw propellers a considerable difficulty has been experienced when the screw has not been kept in regular work, but has been required to stand still for several hours, or even days together, as is more particularly the case with war steamers. In such cases it has been found requisite, in timber vessels having copper sheathing, to protect the wrought iron screw-shaft by a brass casing, wherever exposed to the action of the sea water; since otherwise, the galvanic action excited by the copper, causes a serious and rapid corrosion of the iron shaft, and its bearings soon become injured. A similar action takes place also in iron vessels, but not to the same extent. The shaft is consequently cased throughout with a brass tube, A, as shown in the longitudinal section, Fig. 1, and the transverse section, Fig. 2; the tube A, fits close to the shaft B, at the journals, and is loose from it between them. But the friction and wear at the bearings is in this construction very great, as the brass casing of the journals has to turn in brass bushes; and the result is a very rapid wear, and a great

WOOD BEARINGS.

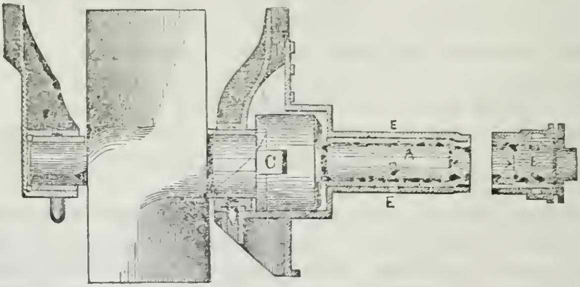

Fig. 1.—Longitudinal Section.

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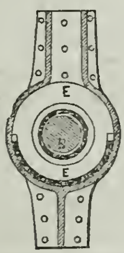
* From the Lond. Artizan, July, 1856.

difficulty in keeping the bearings long at work. Moreover, the screw propeller itself is a heavy mass, weighing in some cases from 10 to 12 tons, coupled at the end of the shaft by a **T** cross head C (Fig. 1), for the purpose of easily unshipping and raising it out of the water by means of the lifting bearers D D, when it is not required for steaming. The wear of the brass bush is very uncertain and various, and has been found to amount to as much as an inch in thickness in the course of a few months.

The author of this Paper, having had his attention forcibly called to the subject by these circumstances, made a series of experiments on different materials as bearing surfaces, and the final result has been the adoption of wood bearings for the screw-shafts, and these have now come into general use for this particular application with complete success.

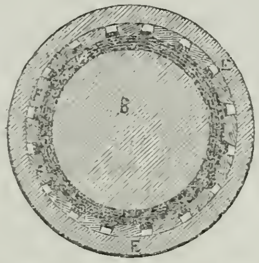
The method in which the wood is employed is shown in Figs. 2 and 3; the ordinary brass bush E, has longitudinal dove-tailed grooves formed on its face, which are filled with strips of hard wood F F; lignum vitæ has been generally used. The strips of wood are about $2\frac{1}{2}$ inches wide, with a space of about three-quarters of an inch between each, and stand out a quarter of an inch from the surface of the brass; water is kept constantly flowing between the strips along the shaft, and forms the only mode of lubrication, and this is found to prevent all tendency to heating or wearing of the journals.

Fig. 2.



Transverse Section.

Fig. 3.



Transverse Section of Shaft and Bearing.

Besides a large number of merchant vessels, upwards of 200 of the last new ships constructed for Her Majesty's service have been fitted with wood bearings, and all former vessels are being altered to the same plan as fast as opportunities will permit. As far as present experience has gone, neither the wood nor the journals appear to suffer any appreciable amount of wear or deterioration after many months continued exposure to the action of the water.

The *Himalaya*, of 3500 tons and 700 H. P., furnishes perhaps the best practical proof that can be adduced of the durability of the wood bearings. This ship was fitted in the first instance with the usual metallic bearings, but the wear was of so serious a nature as to induce the proprietors of the vessel to adopt the improved plan almost immediately after the author's discovery of its utility. The *Himalaya* being shortly afterwards purchased by the Government was employed as a transport, and during the first ten months of her service she steamed 20,000 miles without exhibiting the slightest signs of wear in those parts which had previously given so much trouble. The screw of the *Himalaya* weighs upwards of 11 tons, and is not fitted with the means of raising it out of the water; and consequently, having no after bearing, the whole weight, in addition to the projecting portion of the shaft, is carried by the stern-bush alone.

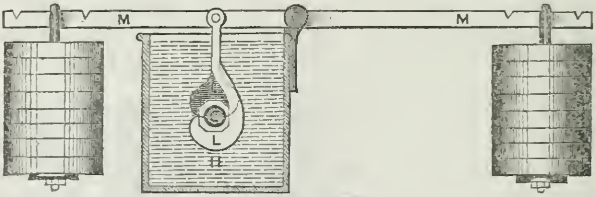
Her Majesty's sloop *Malacca*, of 200 H. P., also furnishes good evidence of the advantages of wood over brass and other metallic bearings. This vessel gave similar trouble to the *Himalaya* as long as it was fitted with brass bearings; but when last examined, since the application of the wood bearings, it had run over a still greater distance than any that it had accomplished previous to the use of them, without exhibiting the least signs of decay or want of adjustment in any of the bearings The bearings had been fitted with lignum vitæ as a leading experiment for ships in the service of the Crown.

The ordinary brass bearings of screw-shafts are made very long in proportion to their diameter, so that the pressure on them is only about 60 lbs. per sq. inch when the journals are in contact throughout; but this pressure is considerably increased in practice, owing to the bearings being sometimes thrown out of line by the straining of the vessel.

In the wood bearings, the surface is reduced more than $\frac{1}{4}$th by the space left between the strips of wood; but it appears from the results of working, that $\frac{1}{10}$th of the area of bearing surface is sufficient with wood as compared with brass. The wood bearings are found to stand a working pressure as great as 2000 lbs. per sq. inch; and in some experiments made to ascertain the point at which abrasion would commence, a pressure of 8000 lbs. per sq. inch was sustained without producing abrasion; whereas brass on an iron bearing at a pressure of 200 lbs per sq. inch was found to cut directly, whether lubricated with oil or water, and failed quickly by the rapid cutting or abrasion.

The experiments which led the author to the adoption of the wood bearings were made with the apparatus shown in Figs. 4 and 5, consisting of a wrought iron axle, G, $1\frac{1}{2}$ in. diameter, running in wooden bearings at each end of a trough of water, H, 2 feet long. The axle was immersed wholly in the water, and driven by a pulley J, on the outer

APPARATUS USED FOR EXPERIMENTS.—Fig. 4.—Transverse Section.



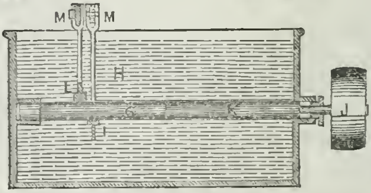


Fig. 5.—Longitudinal Section.

end, at a speed of 700 revolutions per minute, representing a velocity of 260 feet per minute at the circumference of the axle, which corresponds with or rather exceeds the ordinary velocity of the journals of screw-shafts. One-half of the length of the axle K, was covered with brass, the object of which was to try alternately the effect on brass and iron under precisely the same circumstances. A cylindrical bearing 1½ inches diameter and 2 inches long, was turned on the centre of each portion of the axle, upon which were placed the experimental bearings of which the relative frictions were to be ascertained; and in order to prevent any source of error from friction in the fixed bearings at the extremities of the axle, two experimental bearings, L L, were used at the same time, placed close together side by side, one above and the other below the axle, and pressed against the journal in opposite directions by two weighted levers, M M, having adjustable weights to regulate the pressure. By this arrangement, the axle was, as it were, suspended freely in the trough of water, having no material friction in the fixed bearings at the extremities.

The relative friction of the different materials under trial was measured by the rise of the temperature of the water in the trough in a given time, caused by the rotation of the axle, the quantity of water being exactly 2 cubic feet in each case, and at the same initial temperature. In estimating the pressure to which the bearings were subjected, 1 sq. inch of bearing surface was used, and the total weight on each bearing gave the pressure in lbs. per sq. inch.

The particulars of the experiments are given in the Table appended, and the general results obtained were as follows:—

Description of Bearing.	Pressure per sq. in.	Time of Running.	Result of Experiment.
	lbs.		
Brass on Iron,	448	30 minutes.	Little or no cutting.
" "	675	1 hour.	Cut and abraded.
" "	4480	—	Seized and stuck fast immediately.
Lignum Vitæ on Iron,	1250	36 hours.	No signs of wear; original slight scratch not worn out.
Box on Brass,	4480	5 minutes.	Not cut.
Lignum Vitæ on Brass,	4000	5 minutes.	No injury. This specimen is shown full size in Fig. 6.
Snake-wood on Brass,	4000	5 minutes.	No injury. Shown full size in Fig. 6.
Cam-wood on Brass,	8000	5 minutes.	" " " Fig. 7.

In the foregoing experiments, the principal object was the prevention of the serious evils attending the ordinary bearings of screw-shafts; and

PIECES OF WOOD EXPERIMENTED UPON.

Fig. 6.—Full Size.

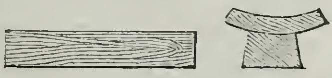
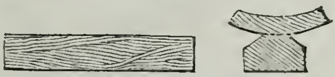


Fig. 7.—Full Size.



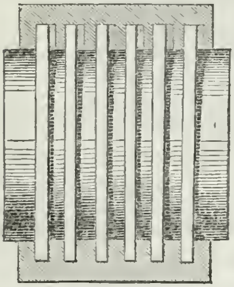
the circumstances under which the experiments were conducted were therefore arranged to correspond as nearly as possible with those experienced in the actual working of ordinary screw-shafts; the experimental axle was wholly immersed in salt water, and was driven in all cases at a speed equivalent to that of screw-shafts on the largest scale.

The result obtained from these experiments was so definite and satisfactory that arrangements were immediately made for the application of the wood bearings to the screw-shafts of Her Majesty's ships, and these have in every instance succeeded beyond expectation. The author proposes, however, to resume the experiments on the first opportunity, in reference to the application of the wood bearings to other purposes in machinery, and he will be happy to communicate the results to the Institution on a future occasion.

The general results at present appear to point to the use of a plentiful supply of water, to carry off the heat caused by the friction of the bearings; and in the cases where this can be accomplished thoroughly, so as to carry off the heat as fast as it is generated, a brass journal revolving in hard wood bearings is practically perfect, showing no perceptible wear under a much more severe pressure than is usually met with in machinery. The two rubbing surfaces appear in reality to run without any lubricating material between them, and the water acts merely as a conductor to carry off the heat as rapidly as it is produced.

One other application of the wood bearings may be mentioned, which has been practically tried, and found very advantageous. The bearing which receives the thrust or propelling effect of the screw in the direction of the vessel's motion is formed of a series of collars on the shaft, running in corresponding grooves in the brasses, which have been found to wear very seriously, in a similar manner to the main bearings of the screw-shafts. The thrust-bearing of the *Himalaya*, which is shown in Fig. 8, had the brasses worn away longitudinally nearly three-quarters of an inch at each collar, and this was repaired by the engineer whilst on the voyage, by putting in a set of rings of lignum vitæ as an experiment, filling up the worn space, as shown in the upper half of Fig. 8. The wood was merely sawn into half rings, the lower pieces being slipped in from above, without lifting the shaft from its bearing. This plan answered completely, and no perceptible wear was found in the wood rings after the voyage home, the original saw marks not even being effaced; and the bearing proved so satisfactory, although only temporarily constructed, that the vessel has gone to sea again without any alteration. In this case the wood bearing was allowed to work most of the time with oil alone as a lubricating material.

Fig. 8.



Of the various kinds of wood that have been tried in the experiments, lignum vitæ appears to be very satisfactory, and nearly as good as any, and it has the practical advantage of being less expensive, and readily obtainable.

TABLE *of Experiments on Friction of Bearings.*

Description of Bearing.	Area of Bearing.	Total Pressure.	Pressure per sq. in.	Time of Running.	Result of Experiment.
	sq. in	lbs.	lbs	min.	
Brass on Brass,	⅛	448	3584	15	
Box on "	1	560	560	10	Marks not out.
" "	⅛	448	3584	5	Not cut.
" "	⅛	560	4480	5	"
" "	⅛	560	4480	5	"
" "	⅛	672	5376		Cut and abraded; side grain.
" "	⅛	672	5376	5	End grain; not cut.
Lignum Vitæ on Brass,	1	672	672	15	Scratches made with tip of knife; not touched.
" " "	⅛	560	4480	5	Cut a little.
Brass on Brass (salt water)	1	448	448	30	Little or no cutting.
" " " "	⅛	448	3584	6	
" Iron,	1	448	448	5	Cut.
New Brass on Iron,	1	560	560	10	"
Brass on Iron,	1	675	675	60	" and abraded.
" "	⅛	560	4480		Would not revolve; seized and stuck fast immediately.
Babbitt's Metal on Iron,	¼	400	1600	8	Rolled out sideways.
Kingston's " "	¼	400	1600	6	" "
Box on Iron,	1	448	448	30	No perceptible wear.
" "	⅛	448	3584	19	
" "	⅛	448	3584	5	But little worn.
Lignum Vitæ on Brass,	1	560	560	10	Mark not out.
" "	1	1250	1250	2160	No signs of wear; original slight scratch not out.
" "	¼	1000	4000	5	No injury.
Snake-wood on Brass,	¼	1000	4000	5	" "
Cam-wood "	⅛	1000	8000	5	" "

Mr. F. P. SMITH stated that, in the unavoidable absence of Mr. Penn from illness, he had attended the meeting in his stead, and would be able to give any further explanation that might be desired upon the subject, as the experiments upon the wood bearings had been conducted under his own superintendence. He exhibited a number of specimens of bearings that had been experimented upon, consisting of different kinds of wood, and also of ivory, brass, and white metal, and said that the experiments would have been conducted further, as had been suggested, had time allowed; but the bearings of the screw-shafts in the war steamers that were under consideration were wearing away so fast, that Mr. Penn was glad to be able to arrive at a practicul conclusion at once, as to the mode of stopping the evil that had been the special object of the inquiry, particularly as the results of the experiments, so far as they had been carried out, had proved so much more satisfactory and definite than could have been anticipated. The pieces of wood that had been used for trial were apparently insignificant, and their small size might cause the experiments to be looked upon as not sufficiently practical; but it had been found in the first trials that a pressure of

1000 lbs. per square inch on a piece of wood of one square inch area would not wear out the scratch of a pin, after running twenty-four or thirty-six hours; and the only available method at the time of increasing the pressure per square inch had been to reduce the size of the pieces of wood, retaining the same weights in the apparatus with which the experiments were made. The slips of wood of 1 inch in length had accordingly been reduced in width to $\frac{1}{4}$th inch, in the expectation that a few minutes would suffice to give a definite result, but no wear could even then be produced; the area was then reduced to $\frac{1}{8}$th square inch, and still no abrasion took place under a pressure of 1000 lbs., or 8000lbs. per square inch; the experiment was limited to this pressure by the slipping of the strap upon the pulley by which the shaft was driven. The little bit of wood used in this experiment had been left running for three hours at a speed of 260 feet per minute, and had been tried in both fresh water and salt water, the latter salter than the sea, with no difference in the result. A brass bearing that had been driven at the same speed had been cut immediately at a pressure of 220 to 231 lbs. per square inch, so remarkable was the difference between wood and brass; and Babbitt's soft metal, Kingston's metal, and other mixtures, had also been tried, but were not capable of working under a pressure at all approaching that admissible with the wood bearings. Several soft woods had been tried, all of which stood well; and among them poplar, which was a very soft wood, stood a heavy pressure with very little wear. It was the intention of Mr. Penn, at the earliest opportunity, to try a second series of experiments, in a more complete manner, carrying them out, if possible, to the limits in each case of the material tested. The test to which the wood bearings had been subjected in the *Himalaya* was the severest to which it was possible that they could be exposed in practice. In this vessel, the screw was made without any provision for drawing it up, and had accordingly no after-bearing in the rudder-post; the weight of the screw was 11$\frac{1}{4}$ tons, or 13 tons with the overhanging portion of the shaft, and the bearing being 18 inches in diameter, and 4 feet in length; the pressure was about 60 lbs. per sq. inch. The wood was applied in twenty strips, each 4 feet long and 3 inches wide, fitted close together round the inner circumference of the bush, the edges being beveled so as to leave a groove nearly 1 inch wide between each of the strips of wood, for the water to flow through. After running 20,000 miles with the wood bearings the vessel had occasion to change her screw, thus affording a good opportunity for examining the condition of the bearings, and it was found that the total clearance of the shaft in the bearing did not amount to $\frac{1}{8}$th inch at the top, including the clearance which there must have been when originally fitted. The *Malacca* also had run 30,000 miles without any signs of wear in the wood bearings.

Mr. James Brown inquired whether the wood bearings had been applied to any rubbing surfaces, such as cross-bar guides, in which the wear was caused by a reciprocating motion; and also whether any trial had been made of them for main shaft bearings.

Mr. Smith replied that they had not yet been tried for a reciprocating motion, but had been applied to the bearings of a crank shaft driving the machinery in Mr. Penn's factory. In this application, however, the wood had not proved superior to brass, and was attended with some inconvenience, as special provision was required to ensure a liberal supply of water to the bearings, otherwise the wood was speedily charred, and became useless. It had also been tried for the crank pin of the *Malacca*, but was not found better than other bearings, such as soft metal; in such situations there were no means of maintaining the wood in a water bath to keep down the temperature, which appeared to be essential in the use of wood for bearings.

The CHAIRMAN observed that the hard wood specimens that were exhibited had got a fine polish upon their rubbing faces, and probably required to be kept always under water for that purpose. They appeared to have been dove-tailed into the brass bush in every case, and this precaution would be necessary in order to prevent them from spreading laterally under great pressures.

Mr. SMITH said that in the wood bearings considerable heat was generated with the very heavy pressures in the experiments, and the wood became so hot, although immersed in water, that it could not be touched with the hand, showing how rapidly the bearing would have heated, if the heat had not been continually carried off by the surrounding water. Oil had been tried instead of water, and gave no difference in the result, if used in a large quantity like the water, but it did not answer if applied only in the same quantity as to ordinary brass bearings, as there was then not enough to carry off the heat as fast it was generated.

The CHAIRMAN observed that the complete immersion of the whole bearing in water appeared to be an essential element in the successful application of wood, and he suggested that in future experiments a thermometer should be applied direct to the wood or metal bearing under trial, in order to ascertain the exact temperature, as it was evident that this would be somewhat higher than that of the surrounding water. The same experiments might be made very serviceable to determine the relative friction of the various kinds of wood and metal tested. He inquired whether wood had been tried in different positions of the fibre, endways as well as lengthways of the grain.

Mr. SMITH replied that it had been tried in all three positions, endways, in the direction of the fibre, and transversely to the fibre; but the experiments had not been continued long enough to test their relative value. He was inclined to think the endway of the grain was the best mode of applying wood, and this had been done by drilling a set of shallow holes in the bush, into which wood-plugs were fixed; but this plan was objectionable in practice, as the wood-plugs were liable to fall out when dry, and the readiest mode of application was flatways, that is, so that the friction would be transversely to the fibre; the latter method had been hitherto exclusively adopted in the wood bearings of screw-shafts, and the wood could be readily and quickly applied to existing bearings, by planing out dove-toiled grooves in the brass bush. In the experiments, the heating of the brass and wood had been measured by the rise of temperature of the water in the trough, and the results had been very marked; with the brass bearing, under a pressure of 200 lbs. per square inch, the temperature of the two cubic feet of water rose to 120° or 130° in one hour, whilst with the wood bearing, under a pressure of 4000 lbs. per square inch, the temperature never exceeded 90° after any length of time, the heat beyond that limit being dissipated as fast as generated.

Mr. HAWKES remarked that he had had an opportunity of seeing the *Himalaya*, immediately on her return from her first voyage, and on inquiring how the stern stuffing-box of the screw-shaft was kept constantly tight, was told that it was not found necessary it should be kept tight, and it was even preferable to have it loose, allowing the water to flow through freely; the vessel had indeed made part of the voyage with the stuffing-box gland entirely removed, the water running through in a large stream, and being pumped out by the bilge-pump, and the result had been successful in keeping down the temperature of the bearings. He inquired how much water was allowed to run through with the wood bearings, and whether any extra pump was generally required to remove it.

Mr. SMITH said that the gland was frequently let loose to allow the water to flow through, about as much water running in as would fill an inch pipe; this water was ordinarily left to run into the bilge, and pumped out by the bilge-pump, without the provision of a special pump. He might mention that in one instance, where the brass bearing was cutting severely, he had observed that the water running from the stuffing-box was impregnated with fine brass scales, to such an extent that seven ounces were caught in a couple of hours.

The CHAIRMAN remarked that the paper contained much interesting and important information, and he hoped Mr. Penn would continue the experiments under different circumstances of speed and pressure, and with dry wood as well as under water, and would communicate the further results to the Institution at a future meeting. He proposed a vote of thanks to Mr. Penn, and also to Mr. Smith, which were passed.

AMERICAN PATENTS.

List of American Patents which issued from July 1st, to July 22d, 1856, (inclusive,) with Exemplifications.

JULY 1.

1. For an *Improved Mode of Securing Tires on Wheels;* William A. Ashe, City of New York.

Claim.—"Making the tire with a narrow tongue at the centre of its width on its inner circumference, and the outer periphery of the circle of felloes, with a groove to receive said tongue, for the purpose of confining the tire on the wheel, and in order that the metal on the tire on either side of said tongue may be made quite thin, and of unvarying thickness from the tongue to the said edges of the tire."

2. For an *Improvement in Dental Forceps;* Hazen J. Bachelder, West Fairlee, Vt.

Claim.—"Applying or connecting the forceps and the bearer, by a stirrup and slot, irrespective of the universal joint, or the equivalent thereof, so that the distance between the extreme end of the bearer and the points or ends of the jaws or forceps may be adjusted, or, in other words, either increased or diminished as circumstances may require."

3. For an *Improved Machine for Sawing Felloes;* David Bowen, Wadesville, Va.

Claim.—"The plank clamps, simultaneously adjustable in opposite directions, in combination with the mechanism connecting the case with the saw-gate."

4. For an *Improved Brake for Wagons;* D. F. Breed, Fulton, New York.

Claim.—"The combination and arrangement of the revolving blocks, rubbers, connecting rods, crank lever and yoke."

5. For an *Improvement in Melodeons;* Jeremiah Carhart, City of New York.

Claim.—"1st, The coupler, arranged in a cavity of the key. 2d, The double springs, constructed to act each on a valve of each set, so that by turning it the two valves may be liberated and capable of removal."

6. For an *Improved Machine for Reaming and Tapping Gas Fittings;* Henry A. Chapin, Springfield, Massachusetts.

Claim.—"The rotating tool holder, in combination with the revolving check or clamp for holding the fitting."

7. For an *Improved Method of Framing and Straining Wood Saws;* E. S. Clapp, Montague, Massachusetts.

Claim.—"Constructing the saw frame with the two bows connected by a hinge, and having the rack attached to the bow, the rack passing through a slot in the bow—the saw being connected to the bows, and the straining rod connected to the bows."

8. For an *Improvement in Rotating Pumps;* Charles N. Clow, Port Byron, N. Y.

Claim.—"Cams or pistons, having smooth peripheries made to revolve with the peripheries in contact, to form the abutment by gear wheels, on the same shafts as said cams, the pitch line of which gears correspond in shape with the peripheries of the cams."

9. For an *Improved Metallic Pen;* Alphonso Craytey, Brooklyn, New York.

Claim.—"The pen point protector and ink distributor, in combination with metallic pens."

10. For an *Improvement in Concentrating Apparatus for Sulphuric Acid;* William T. Clough, Newark, New Jersey.

Claim.—"The construction of a furnace so that the sulphuric acid will not affect or injure the lead or mineral tank or pan during the process of concentration, by means of a hot surface being placed above the liquor."

11. For an *Improvement in Machines for Cutting and Coring Apples;* Cook Darling, Utica, New York.

Claim.—"The machine for dividing and coring apples at one operation—the knives having a lateral as well as a vertical motion in their descent, so as to separate the core by a cut, wider in the centre than at the ends."

12. For an *Improvement in the Base-piece of Locomotive Smoke Stacks;* Peter S. Ebbert, Chicago, Illinois.

Claim.—"The construction of saddles or base pieces, for the stacks or chimneys of locomotives, in which the feed water for the boilers is heated in the trough or receiver for catching the water or condensed steam that drips—and the waste pipe for conveying it away."

13. For an *Improved Metallic Hook for Labels;* Samuel B. Fay, City of New York.

Claim.—"The construction of tags or labels, by affixing thereto a hook, so formed as to readily hook into the goods to be marked—and by the spring of its shank retain its position, without being liable to become readily detached."

14. For an *Improved Method of Operating Valves of Steam Pumps;* Robt. H. Fletcher, Brooklyn, New York.

Claim.—"Enclosing the piston head within an inner cylinder, which fits within the outside cylinder of the pump—said inner cylinder being somewhat shorter than the space between the outside cylinder heads, and so constructed as to alternately open and close the ports through which the water passes in and out of said pump, and operated by the piston."

15. For an *Improved Method of Making Boxes of Paper Pulp;* Arasmus French and Charles Frost, Waterbury, Conn.

Claim.—" 1st, The method of disengaging the article when formed from the mould, by forcing air upon it, by bringing down the piston, or other equivalent means. 2d, The use of the movable block and the movable shelf with a cavity in it—both block and cavity corresponding in shape to the boxes or article made, and are used to receive them and preserve their shape when they are blown from the mould. 3d, The circular groove in the rim, and such a construction of the plate to which the mould is attached as would be equivalent to it—the object of this groove being to receive the water which enters the cylinder through the perforated mould, when the pulp is deposited thereon, so that it may be drawn off by the stop-cock—whereas, this water, if permitted to remain and accumulate, would, by the pressure of the air upon it, be forced through the sides of the article formed, when they are blown from the mould."

16. For an *Improvement in Steam Pressure Regulators;* William S. Gale, City of New York.

Claim.—" The arrangement of the groove in the piston, in connexion with the gasket."

17. For an *Improved Machine for Sawing Stone;* John Grason, Queenstown, Md.

Claim.—" Operating double sets of saws, arranged at right angles with each other, by means of the power-moving rack beam, combined with the rack beam, by means of the toothed wheel, which works upon the adjustable sliding beam."

18. For an *Improvement in Refrigerating Pitchers;* Franklin D. Hall, Philadelphia, Pennsylvania.

Claim.—" The arrangement of the tube or conduit pipe, and the spout with which it is connected."

19. For an *Improved Paper Clip;* John L. Harvey and C. A. Mills, Dubuque, Iowa.

Claim.—" The attachment of the clip and spring to the outer cylinder, by which the clip can be raised or lowered, so as to accommodate to a larger or smaller quantity of paper, the effect of the spring upon the clip being the same in any position."

20. For an *Improved Method of Turning Carriage, &c., Axletrees;* John Hennon, Brighton, Pennsylvania.

Claim.—" The turning of spindles on axles for carriages or all other similar articles, and the rule or principle of ascertaining the lines on the timber, and of finding the centre in accordance therewith—and of so adjusting a movable centre or slide point in any common lathe, as to give an axle any desired degree of inclination for the bottom or pitch line, and at the same time obtaining more or less gether at will."

21. For an *Improved Mode of Adjusting Carriage Springs;* M. G. Hubbard, Penn Yan, New York.

Claim.—" The double fulcrum iron with a changeable angle."

22. For an *Improvement in Bedsteads;* Silas Huddleston, Cottage Grove, Indiana.

Claim.—" The arrangement, consisting of the device, end rail, and stop pin, for the purpose of tightening and retaining the cord which forms the bottom of the bedstead."

23. For an *Improvement in Harvesters;* John C. Huermann and Jonathan Reeves, Camden, New Jersey.

Claim.—" The wheel with its projection, in combination with the levers and their scrapers, the rods, levers, arms, for the double purpose of clearing the projections from dirt, and agitating the cutters."

24. For an *Improvement in Raking Attachment for Reapers;* John C. Hicks, Rockaway, New York.

Claim.—" Operating the rakes by means of the segments and rack with pin attached, in combination with the slotted arm or crank, and groove in the platform."

25. For an *Improved Match Machine;* Lawrence Holmes, Paterson, New Jersey.

Claim.—" 1st, The combination of the reeding rollers and separating collars. 2d, In combination with the above die-plate and knives for completing the splint. 3d, The shield."

26. For an *Improvement in Disinfecting Pastiles;* Andrew Lanergan, Boston, Mass.

Claim.—"A disinfecting pastile or composition, made so as to be capable of being ignited and burned, and while burning to evolve chlorine and hydrochloric acid gas, either in a free state, or so combined or mixed with one or more other gases, as to be capable of acting as a disinfecting agent."

27. For an *Improved Gun Carriage;* John Laurens, Charleston, S. C.

Claim.—"The entire gun carriage, it being totally different from any gun carriage that is now, or ever has been in use, with the sole exception of its carrying a gun."

28. For an *Improvement in Netting Machines;* John McMullen, Baltimore, Md.

Claim.—"Finishing the meshes of the net and tightening the knot, by the simultaneous longitudinal and lateral strain of pressure-rollers and cloth beam—the relative position of said rollers and beam being automatically preserved."

29. For an *Improvement in Steam Gauges;* W. K. Miller, Canton, Ohio.

Claim.—"The arrangement of the syphon tube, within the cement holding tube or case, and both within the metal case, with transparent front, and thereby forming cement and transparent liquid chamber within the case."

30. For an *Improved Brass Kettle Machine;* O. W. Minard, Waterbury, Conn.

Claim.—"The method of polishing or burnishing either of the surfaces of the metal, during, and by the rolling action, by causing one of the rolling surfaces to move faster or slower than the other, to produce a slip. Also, in combination with the forming and working rollers giving to the carriage which carries the clamps with the disk of metal, a diagonal movement, to keep the inner surface of the metal in contact with the forming roller, during the rolling action."

31. For an *Improved Machine for Mincing Meat;* Oren Moses, Malone, New York.

Claim.—"The combination of the cutting box with the cutting cylinder, and with the other parts of the machine, in such a manner, that the position of said box can be readily lowered, partially revolved, and then elevated again for the purpose, causing the reciprocating movements of said box to so act upon the disks of the cutting cylinder, as to make them cut in transverse directions within said cutting box. Also, the combination of the comb and its shaft, with the shaft of the cutting cylinder, in such a manner, as to cause the teeth of said comb to act between the cutting disk on the rising side of the cutting cylinder."

32. For an *Improved Bedstead;* Ansel Moon, Bristol, Wisconsin.

Claim.—"The application of the 'lock joint,' (so-called,) to the manufacture of bedsteads."

33. For an *Improvement in Swinging Spout for Feeding Mill Stones;* Milton and Charles Painter, Orange Mills, Maryland.

Claim—"Suspending the oblique eye feeding tube, by universal joint from above, in combination with, and for free rotation and universal movement of said tube by the revolving stone."

34. For an *Improvement in Independent Seconds Movement for Watches;* George P. Reed, Waltham, Mass.

Claim.—"The combination of the gear wheel, the ratchet, curved lever, draw pawl, the spring, the detacher, the whole constituting a mechanism, applicable to the arbor of the index hand of a dial, and for imparting to the same an intermittent rotary movement."

35. For an *Improvement in Reaping and Mowing Machines;* John Reily, Hart Prairie, Wisconsin.

Claim.—"1st, The method of raising and lowering the cutter bar, either from the driver's or raker's seat, or from both simultaneously, by means of the rod and lever, in combination with the lever. 2d, Hinging the driver's seat to the drag tongue, when combined with a brace, pivoted to the axis of motion of the machine."

36. For an *Improved Machine for Sweeping Streets;* D. H. Richards, Georgetown, Massachusetts.

Claim.—"1st, The brush, operated by means of the cam groove. 2d, The plate operating for the purpose of raising the brush upon the return stroke when sweeping at the sides of the streets."

37. For an *Improvement in Machines for Making and Kneading Bread;* Socrates M. Ridgaway, St. Michaels, Maryland.

Claim.—"The combination of the fluted roller, with a knead trough."

38. For an *Improvement in Corn and Cob Mills;* Cyrus Roberts, Belleville, Illinois.

Claim.—"The method of rendering the grinding surface of the hull or concave concentric with that of the ball—and of preserving this concentricity, by mounting the revolving spider, between the arms of which, the rim of the hull is secured and adjusted, upon a neck or journal formed on the underside of the ball."

39. For an *Improved Balance-Gate for Flumes in Water Power;* Daniel Robison' Senoxville, Pennsylvania.

Claim.—"The two sliding gates placed at opposite sides of the penstock, and connected by bars."

40. For an *Improvement in Blasting Powder;* William Silver, Jr., Wapwollopen, Pennsylvania.

Claim.—"The explosive compound herein described, consisting of rags or paper saturated and coated with a mixture of gunpowder, chlorate of potassa, and powdered calcined cork."

41. For an *Improvement in Locks;* Henry Isham, New Britain, Conn.

Claim.—"Moving a series of rotating cogged tumblers at right angles to the line of motion of the bolt by means of a slot in the bolt, or any equivalent thereof, operating on the shaft or spindle of the tumblers, whereby the cogs on the said tumblers can be made to engage the cogged racks on the key slides previously set by the key before the stop pin on the bolt leaves the slots in the tumbler, and will so remain engaged while the bolt continues its movement to carry the said stop pin to some distance beyond the periphery of the tumblers, so that in any attempt to pick the lock, the said stop pin shall not rest against the peripheries of the tumblers to admit of feeling, as it is called, to bring the tumblers in succession to the required position to allow the lock to be picked. Also, in combination with the method of operating the tumblers by the throw of the bolt, and giving to the bolt the capacity to move after the tumblers have been engaged with the key slides to carry the slot pin some distance beyond the periphery of the tumblers, the employment of a stop or hold-fast, operated by the bolt to lock or hold-fast the key slides or tumblers before the stop pin on the bolt reaches the periphery of the tumblers, whereby the said slides and tumblers, if not previously arranged by the proper key, will become locked in their disarranged condition, before the stop pin on the bolt can reach the peripheries of the tumblers, to feel when the tumblers are brought to the required position by a pick. Also, forming the bitt of the key of a series of sector pinions, which may be shifted to change the combination or permutation, in combination with a series of cogged rack slides for operating the tumblers. Also, the notched collar on the key stem, in combination with the lipped spring at the entrance of the key hole, whereby the key cannot be taken out of the key hole without turning it entirely around, to give to the key slides their entire range of motion every time the lock is opened and shut, and thus avoid the possibility of determining the required position of the key slides by the wear of the moving parts, which would be the case if only moved each time to the distance required for unlocking, particularly, if the same combination should continue to be used for a considerable length of time."

42. For an *Improvement in Breech Loading Fire Arms;* Benjamin F. Joslyn, Worcester, Massachusetts.

Claim.—"A sliding valve in a chamber. Also, combining the spring with the valve."

43. For an *Improved Machine for Grinding Butt Hinges;* Cyrus Kenney and Wm. Gurley, Troy, New York.

Claim.—"The improvement for hanging the pinch block or cam, on or to the elastic support, arranged in combination with the bed and stop. Also, mounting the griper upon the rock shaft, arranged in combination with the grindstone."

44. For an *Improved Marble Sawing Machine;* Henry Lawrence, City of N. York.

Claim.—"Mounting the two saw frames each in ways on the side of the frame, in combination with, and when such frame is provided at its ends with slides fitted to slide up and down in separate ways, connected with the main frame by journals or stems adapted to turn and slide in suitable slots, and there held and secured, whereby the said saws can be set each independently of the other, to have its cutting and feeding motions at any desired angle by simply turning or shifting the journals of the said ways. Also. in combination with the before described manner of mounting the two saw frames in adjustable sliding frames adapted to shifting and turning ways, the mode of imparting motion to said saw gates, by means of pitmen or connecting rods hinged at one end to the saw gate, and at the other fitted to slide and turn in rockers mounted in and free to turn in a rocking frame, which receives motion from some suitable motor."

45. For an *Improvement in Curtain Fixtures;* James Stephens, City of New York.

Claim.—" Attaching the coil spring to a swinging pendant, and connecting the same to an arbor, to which the shade roller is attached by the pinion and the toothed wheel, the arbor having a ratchet upon it, in which ratchet a pawl attached to the pendant catches."

46. For an *Improvement in Steam Pressure Indicators and Regulators;* William Mt. Storm, City of New York.

Claim.—" The combination of a simple steam-tight metal tube, with a fixed and open (not steam-tight) frame or support, in which both of its extremities are held stationary, while the motion of its middle left free, is communicated to its work, in such manner, or by a device combined with the instrument, as to multiply its range of action; the communication of the tube with the steam of the boiler being separate and distinct, moreover, from that to the water space of the boiler, and filled with a cold fluid, and so arranged as not to allow any circulation through it of the heated water from the boiler. Also, in combination with the tube, the 'key nut,' or its equivalent."

47. For an *Improvement in Cotton and Seed Planters;* J. A. Stewart, Franklyn, Ky.

Claim.—" The hopper or wheel formed of the disks, and zig-zag rim, provided with slats. Also, the hopper or wheel, in combination with the clearing rod or spike."

48. For an *Improvement in Machinery for Felting Hat Bodies;* Joseph Thomas, Brooklyn, New York."

Claim.—" Giving the vibrating motion to the reservoir wheel, by the combined action of the screw and cam, or any equivalent device."

49. For an *Improved Filter Attachment for Faucets;* James H. Wright, City of New York.

Claim.—" Placing the filtering material or medium, within the chamber of the faucet and above the pipe, and having a pipe and cock at the upper end of the chamber, and a pipe and cock at its lower end. Also, placing the filtering material or medium upon the bars."

50. For an *Improved Guard Finger for Harvesters;* Walter A. Wood, Hoosick Falls, New York.

Claim.—" The particular form and construction of the finger or guard, viz: with the forked cap, recess or depression, raised edges and neck behind them, by means of which, the cutting is facilitated."

51. For a *Macaroni Server;* Abner L. Lincoln, Assignor to self and Charles M. Foss, Boston, Massachusetts.

Claim.—" The described 'macaroni server,' as made with its teeth or prongs arranged with respect to its blade."

52. For an *Improvement in Dry Lime Gas Purifiers;* Charles F. Werner, City of N. York, and Charles Deutschmann, Buffalo, New York.

Claim.—" The arrangement of the lime purifier in the same vessel or cooler with the cooling pipe, when the said cooling pipe is arranged in form below the purifier."

53. For an *Improvement in Machines for Hulling and Scouring Grain, Seed, &c.;* Oliver P. Stevens, Cleveland, Ohio.

Claim.—" 1st, The perforated fans, in combination with teeth set in the fan case. 2d, The arrangement of the upper section of the fan case, in its relation to the chimney, in combination with the fans and guides. 3d, The adjustable guides or deflectors. 4th, The air passages or chambers arranged in each end and on the top of the fan case, in connexion with the vertical trunk. 5th, The valve, operated in the manner described, and in combination with the chimney."

54. For an *Improved Magazine Hammer for Fire Arms;* James N. Ward, United States Army.

Claim.—"The feed wheel, ratchet and pawl, in combination with each other, and the coil chamber in the hammer head; said wheels being so situated relative to the pawl, that the outer face of the feed wheel shall be within the inner plane of the pawl cavity. 2d, The combination of the core with the hammer, for severing the protruding portion of the primer, and closing the primer passage."

55. For an *Improvement in Machines for Mowing Grass and Cutting Grain;* Anson S. Hathaway, Assignor to self and Frederick Ruggles, Columbia, Maine.

Claim.—"The scythes, when arranged in relation to each other, and operated in mechanism constructed and arranged as described, in combination with the peculiarly constructed and independent acting guards."

56. For an *Improvement in Machinery for Combing Wool;* Wm. H. Walton, Assignor to self and J. E. Winants, Brooklyn, New York.

Claim.—"1st, The reversing comb, arranged as described, for conveying the wool from the feed rollers past the cylinders and on the endless chain comb. 2d, In combination with the above named reversing comb, the brush in rear thereof. 3d, The clearing bar for clearing the fibres of wool from the cylinder before the comb reverses, when combined with the reversing comb."

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57. For an *Improved Padlock;* Solomon Andrews, Perth Amboy, New Jersey.

Claim.—"Making a spring to answer the double purpose of a spring and ratchet tumbler, which I denominate a spring-tumbler. Also, the opening spring, being a spring brought into action by the key, for the purpose of drawing back the hooks, or unlocking the locks. Also, the combination of the spring-tumblers with the hooks, holding back the hooks when unlocked, so as to constitute a perfectly racked tumbler lock a self-locking one."

58. For an *Improved Method of Extinguishing Fires;* Robert B. Armitage, Philadelphia, Pennsylvania.

Claim.—"The arrangement of the main pipe with the branch pipe, the arms and jets, which, in connexion with the cords and levers combined, operate as a self-acting fire extinguisher."

59. For an *Improved Machine for Upsetting Tire;* Henry Barringer, Berry, Ill.

Claim.—"The combination of the slotted bar, the clamping lever and sliding plate, with the clamping lever, for the purpose of clamping and unclamping the tire, with one motion of the lever."

60. For an *Improved Method of Drawing Water from Wells;* H. B. Barber, Scott, New York.

Claim.—"The use of the lever, in combination with the two pawls and toothed pulleys, or their equivalents, for the purpose of automatically arresting the pulleys, when the buckets are at a given height, and keeping them suspended during their discharge. Also, combining the two pulleys, mounted on one shaft, and driven by the same pinion, with the hasp and thumb-screw, for the purpose of connecting or disconnecting said pulleys, and thus working one or two buckets."

61. For an *Improvement in Rotary Pumps;* James A. Bazin, Canton, Mass.

Claim.—"The means employed for moving the two pistons alternately,—the same consisting of the toggle arms attached to the cranks of the pistons, and operating in the circular grooves, in such a manner, as to hold one crank and its piston stationary, while the other crank and its piston are moving."

62. For an *Improvement in Roofing Cement;* Horace Billings, Beardstown, Ill.

Claim.—"My improved roof coating cement, or composition of matter, produced by combining shellac (or seed lac), rosin, linseed oil (or its equivalent), and powdered stealite (or its equivalent), in proportions which will give the said composition the character, and adapt it to the purposes set forth."

63. For an *Improvement in Brick Machines;* E. Brannon and R. Peterson, Green Castle, Indiana.

Claim.—" 1st, The mould box, provided with the plungers—when said plungers are operated by the springs and rods, working in the grooves, for the purpose of allowing the mould box to receive the clay, and also to eject the compressed clay therefrom. 2d, We claim operating the mould box, or giving it a reciprocating motion, with the necessary 'dwells' to allow the box to be filled with clay; and also, to allow the clay to be pressed therein, by means of the rack-bar and wheels. 3d, We claim the combination of the plunger rods, working in grooves, with the mould box provided with the plungers."

64. For an *Improved Vise;* Hiram C. Brown, Yellow Springs, Ohio.

Claim.—" The rod, arranged and operating so that by pushing it back endwise, both ends will be simultaneously raised, and thereby lift the pawl from any part of the ratch. Also, adjusting and retaining the jaws parallel with each other, or to any desired angle, either by varying the length of the brace rod, between its points of contact at the top, and on the movable jaw, or by varying the position of the lower point of contact. Also, the use of the adjustable sliding rod, arranged and connected with the brace rod."

65. For an *Improvement in Dies for Stamping or Pressing Sheet Metal;* William M. Booth and James H. Mills, Buffalo, New York.

Claim.—" Pressing, stamping, or forming metal, viz: the upper and lower dies, or their equivalents—the said dies being movable parts—supported by springs."

66. For an *Apparatus for Hitching Horses, Clothes Lines, &c.;* Edward S. Boynton, East Hartford, Connecticut.

Claim.—" The application of a cam shaped lever for horse hitches."

67. For an *Improvement in Rotary Pumps;* Charles N. Clow, Port Byron, N. Y.

Claim.—" The roller."

68. For an *Improvement in Rotary Steam Engines;* James M. Colman and Thomas Turton, Milwaukie, Wisconsin.

Claim.—" The engine, composed of the rotary piston, struck from three centres, and the three oscillating abutments, with packing pieces at one end of their concave faces, arranged and operating in connexion with the piston in a cylinder."

69. For an *Improved Machine for Rounding and Backing Books;* John E. Coffin, Westbrook, Maine.

Claim.—" The follower clamp, formed by the stationary jaw, and sliding jaw, and the sliding bed, with hammars attached."

70. For a *Tool for Index Lettering;* Edward Crawley, Cincinnati, Ohio.

Claim.—" 1st, The arrangement of a circular revolving head, having around its periphery a series of types, adjustable radially, so as to print an index of greater or less 'display,' by a single rapid continuous movement, using for such purpose the pair of disks, of which one has radial grooves holding a set of types, notched transversely to receive the spiral flanch on the other disk, in combination with the securing and tightening nut upon the arbor and pivot. 2d, I claim, in this connexion, the inking apparatus, having two or more inking rollers, and the distributing mechanism in a vibrating head attached, and supported, to a sliding bar."

71. For an *Improvement in Smut Machines;* R. M. Dempsey, Indianapolis, Indiana.

Claim.—" The concave head, having vertical rods or spikes attached and fitted within an inverted conical screen—the head having wings attached to its underside, and its upper surface corrugated."

72. For an *Improved Stave Jointer;* J. K. Derby, Jamestown, New York.

Claim.—" The vibrating or lifting bed, fitted or pivoted to a bar within the carriage —the bed being operated by the pattern, or its equivalents."

73. For an *Improvement in Securing Pearl Ornaments in Handles of Cast Metal;* Charles Dickinson and Wm. Bellamy, Newark, New Jersey.

Claim.—" Inserting or securing the pearl disks or plates in the handle, by placing the pearl disks in grooves formed in the moulds—the pearl disks having thimbles fitted within them, so that the metal will close around the thimbles."

74. For an *Improved Shutter Operator;* Charles R. Edwards, Niagara City, N. Y.

Claim.—"1st, The tapered or rolling tapered cogs, arranged on the underside of a wheel, or segment of a wheel, so as to mesh with a screw shaft, or spiral thread. 2d, The tapering of the cogs, in a direction towards any practical point between the centre of the wheel and the casing, and so as to mesh with a spiral thread; but I do not confine myself to any particular shape or position of said cogs, or direction of their taper; for cogs might be made to operate nearly in the same manner on the upper side of the wheel, or on a slightly bevel edge of the wheel. 3d, The meshing and operating a screw shaft or spiral thread, with cogs on a wheel, or segment of a wheel, used with the before described combination, and for opening, shutting, and staying the blind, and opening, shutting, and staying the lattice. 4th, The constructing of the shaft in two parts, so that one part may be pushed in, so as to unite or mesh with the other, and slide together, so as to shorten or lengthen the shaft. 5th, The piece, or its substitute, and the plan of the enclosure for holding the screw. 6th, The general plan of opening, shutting, and staying the lattice by means of the knee lever, and with the combination operated by a slight turn of the knob crank."

75. For an *Improved Mode of Attaching Shafts to Vehicles;* Francis J. Flowers, Brooklyn, New York.

Claim.—"The rod on the goose neck or bar, fitted in the eye on the bar; the cap attached to the bar, and the nuts on the rod—the nut having flanches attached to them, and fitting over circular or annular edges on the ends of the cap and eye."

76. For an *Improved Machine for Quarrying and Cutting Stone;* Charles Frost and A. W. Webster, Waterbury, Connecticut.

Claim.—"The combination of the cutter stocks or blocks, and cam—the stocks or blocks being pivoted to the pulley, which is placed on a shaft in the frame, and the cam placed loosely on the shaft."

77. For an *Improvement in Machinery for Felting Hat Bodies;* William Fuzzard, Cambridgeport, Massachusetts.

Claim.—"The apron connected to the vibrating or reciprocating roller, or cylinder, and to the adjustable platform, and arranged in relation with the reservoir, or box."

78. For an *Improvement in Fire Arms;* James E. Halsey, City of New York.

Claim.—"The tube, constructed of such a length, and placed in such a position, that it shall serve as a means for communicating fire from the cap to the forward end of the charge of powder only."

79. For an *Improvement in Brick Machines;* James A. Hamer, Reading, Penna.

Claim.—"The adjustable segment of the guide plate, in combination with the plungers. 2d, Also, dusting the moulds of the mould wheel with fine dry sand, preparatory to their being filled with clay, by means of the arrangement and combination of the blower or fan, the sand box, the shaker board, the arm, weight ball, and shaker rod. 3d, Also, the sliding gate, so constructed and operated by means of a small roller, running in the guide plate, that the mould is filled at the end by means of the screw in the shell, while the wheel is in operation; said gate being closed while the mould is filling, and open during the discharge of the brick."

80. For an *Improvement in Curry Combs;* Asahel A. and Andrew Hotchkiss, Sharon, Connecticut.

Claim.—"The turning of solid corners upon the shell to save riveting, and the serrating of the ends of the shell, to form teeth thereon—the corners of the plate being first scalloped out, so as not to project beyond the teeth, after they are bent up into shape."

81. For an *Improvement in Looms;* Wm. J. Horstmann, Philadelphia, Penna.

Claim.—"The permanent attachment of the pile wires by one end, to independent sliding rods, which are carried each on one side of the warp, and controlled by springs, in such a manner as to allow them an independent movement longitudinally to the warp, by transversely sliding bars—the said rods, bars, and springs, being operated and operating in combination with each other. Also, the spring latches, acting in combination with the rods of the pile wires."

82. For an *Improvement in Reversible Horse Power;* Philip H. Kells, Hudson, N.Y.

Claim.—"Constructing the machine, so that the shaft of the over-reaching belt pulley may be reversible, when the gear wheel shall be shifted to, and secured upon the opposite ends of its shaft, and that in every such position of the pulley shaft, the end of the gear shaft, and the fastenings therein, shall be within the plane of the inner side of the arms, spokes, or face of said pulley; the gear wheel fastenings being the same on both ends of its shaft, and so related to the pulley shaft, that the converge gear shall duly mesh with the pinion of said shaft, at each change of position of these several parts, for the purpose of changing from a right to a left hand machine, or the reverse."

83. For an *Improved Wheel for Steam Carriages;* Alexander B. Latta, Cincinnati, Ohio.

Claim.—"The combination of the tire, angle tire, sectional tire, cross spokes, and jamb nuts."

84. For an *Improved Arrangement of Means for Balancing and Propelling Life and Property Saving Vessels;* James Minifie, Baltimore, Maryland.

Claim.—"The arrangement of the driving wheels, the steel foundation piece, and the rods and brass connected therewith, and with the propellers in relation to the vessel."

85. For an *Improved Stone Sawing Mill;* C. A. Mills, Dubuque, Iowa.

Claim.—"Operating the saws when arranged upon the top of the frame, so as to work at right angles to each other, by means of the feed plate and knuckles, in combination with the mechanism for elevating the block of stone."

86. For an *Improved Apparatus for Raising and Dumping Coal;* Ephraim Morris, Bergen, New Jersey.

Claim.—"The pulleys, geared together so as to prevent the rope slipping, when combined with the ratchet wheel, pawl, and stop, whereby the bucket is sustained in its elevated position, while being drawn along in either direction, and can only be lowered when the pawl is disengaged from the ratchet wheel. Also, the bails, fitted with hooks, to take the loops on the bucket when the same is elevated, and dump the contents thereof, by drawing up said bails. Also, the adjustable rope, with its knot or projection, for taking the traveler, and through the chains and pulleys or drums, drawing up the bails by the motion of the car, and dumping the contents from the bucket."

87. For an *Improved Dove-tailing Machine;* Lysander A. Orcutt, Albany, N. Y.

Claim.—"The combination of the double frames or carriages, for producing the canting or rocking, and the vertical or horizontal motions for cutting dove-tails and tenons, or counters. Also, the variable dog and pattern for spacing, regulating, and holding the stuff under the action of the cutter."

88. For an *Improved Shingle Machine;* Adrian V. B. Orr, Lancaster, Penna.

Claim.—"1st, Combining in a single reciprocating plate, a straight face, a tapering face with an offset between them, and a movable frow. 2d, The compound lever, for the purpose of taking the finished shingle off the plate."

89. For an *Improvement in Tanning Hides;* Samuel W. Pingree, Methuen, Mass.

Claim.—"I claim, when the hide is to be tanned with the hair either on or off, as the case may be, removing, or skiving off the inner layer thereof; or the same and a part or parts of the middle lair of it, preparatory to immersing such hide in the tanning liquor."

90. For an *Improved Method of Guiding Circular and other Saws;* Orrin Rice, Cincinnati, Ohio.

Claim.—"The application of the spring in any shape or form, to any anti-friction substance, to be applied directly against the saw; and by traversing over the uneven surface thereof, preventing the saw from trembling; and for strengthening, steadying, and guiding the same while in motion, thereby enabling a much thinner saw of the same diameter to be used, than otherwise could be, without the application of my improvement—thereby effecting a great saving in power, timber, and repairs. Also, the application to govern the side moving or lateral motion of large saws, for sawing logs, occasioned by the springing of the same."

91. For an *Improvement in Locomotive Reflector Lamps;* F. J. Seymour, Waterbury, Connecticut.

Claim.—"Constructing the reservoir of locomotive lamps, so that the reflector becomes one side of said reservoir, for the purpose of heating the contents thereof, and rendering the same liquid and limpid. Also, constructing the reservoir of locomotive lanterns, by means of a case surrounding the whole reflector, and provided with the air-tight screws, so as to cause said reservoir to become a self-supplying fountain to the burner tube. Also, regulating the supply of oil, or other burning material, to the flame of a lamp, or shutting off said supply, by means of compression on the wick by the cock. Also, placing the chimney to the rear of the vertical line, over the flame, when the draft is supplied at or near the front of the reflector."

92. For an *Improved Horse Shoe;* Sewall Short, New London, Connecticut.

Claim.—"The combination of the cap and shoe, made in two separate pieces—the cap and shoe being constructed separately. I also specially claim the rib and groove, attaching the cap and shoe."

93. For an *Improvement in Breech Loading Fire Arms;* William Mt. Storm, City of New York.

Claim.—"1st, The arrangement of a portion of the barrel at the rear, sufficient to contain the charge, to swing by a hinge upon the exterior, (as quite distinct from *oscillating* upon trunnions,) out from the line of the bore, for the most convenient insertion of the charge, in combination with the stationary wedging incline at the rear, with which it is made to correspond, and which receives the recoil. 2d, I also claim, in combination with the so hinged chamber, the long tapering valve face, projecting across the joint, so far as, by itself, to bolt the chamber into the barrel to such an extent, that no lateral force or blow can displace it from the exact line of the bore, or (as would be the case with an 'obtuse angle' of valve face,) *wedge* the face of the valve laterally against its seat, while at the same time, the taper of said valve face shall be such, in relation to the joint of the finger, that it shall swing out of and into its seat, without slide upon the latter. 3d, Making such valve face upon the end of a loose tube, of some hard unplastic metal, projecting or extending back into the loading chamber, of which it constitutes an essential and permanent part; and of such strength and thickness, that it shall effectually resist any change of size or form by the force of the explosion or expansion thereby, outwardly against the interior of the chamber, by which its freedom to drive bodily forward, as designed in the manner of a poppet valve, into its seat by the force of the explosion, to close the joint, would be prevented, said tube being found open to the full size of its bore at both ends, and thereat slightly exceeding in bore the bore of the gun. 4th, Extending the rear of the so constructed tube so far back into the chamber, and as farther, that the annular edge of its open rear shall terminate opposite to, or slightly in front of, the point of first ignition of the cartridge—so that while its end at this point terminates, and fits closely against the cylindrical sides of the chamber, to prevent the explosion from passing between them, the edge of its end, or the annular surface facing rearward, being purposely exposed to the forward force of the explosion, the tube will be forced ahead to close the joint between the chamber and barrel, at the earliest instant of discharge, to the end, that if the ball should be a loose fit in the tube, and at the same time not a 'Minnie,' and thus permiting escape of gas past it, before it reached and tightened in the creases, the gas should not be left free to pass through the valve joint, causing 'cutting.' 5th, In combination with my tube, a finger or edging of soft metal, soldered to its rear annular edge, and beveling off rearward thinner than the tube itself, so that the thinner edge shall be easily driven by the explosion slightly forward and outward, into the annular corner, formed by the edge of the tube and the side of the chamber, closing the joint between them tightly at this point, but leaving them elsewhere a loose fit, while each thin edging of soft metal cannot have stiffness sufficient to prevent both it and the valve from being freely driven forward in the chamber by the explosion. 6th, The bolt projecting through the recoil bearing into the breech, and so connected with the lock that it must move continuously and simultaneously with the hammer, and, therefore, the fall of the hammer upon the cap being, under all circumstances, made dependent upon the bolt, having properly entered and secured the chamber, while, moreover, by this means, the bolt which might otherwise be prevented from flying forward into the breech by rust or dirt, is thus forced home by the whole power of the lock. 7th, Tapering the forward end of said bolt beneath, that, if the chamber is not quite home to its place when the trigger is pulled, the bolt will bring it so, before the hammer reaches the cap. 8th, Connecting said bolt with the 'tumbler,' by the slotted head, embracing the headless stud or screw in the tumbler, so that there being no actual attachment of the bolt and the lock, the latter may be removed in the ordinary way, without regard to the former. 9th, Cutting away the recoil bearing below the centre of the bore, to insure that the explosion shall tend to throw the chamber more tighly down into the stock, in lieu of any chance tendency upward out of its seat. 10th, The fixed unyielding stud and bearing screw, for receiving the force of this downward action, that it may not be exerted upon the underside of the valve face. 11th, Forming the recess in the stock beneath the chamber, to receive any powder spilled in loading with a 'broken' or leaky cartridge, so that it shall not block under the chamber, and prevent it coming down to a horizontal line and in contact with its bearing. 12th, The arrangement of the hinge of the chamber upon the top of the latter, in lieu of elsewhere, whereby the chamber is thrown over in the most elevated and unobstructed position, for the insertion of the cartridge, while the barrel will then bear the weight of the chamber (when open), and not the joint of the hinge, and the steel need not be cut away and weakened, as would be the case if the chamber swung laterally, and at the same time the hinge can constitute the 'crotch' sight. 13th, Making said hinge a spring, and so arranged as to yield in case of any obstruction tying or adhering in the valve face. 14th, Swiveling the chamber, so that when open it may be twined with its mouth vertically, for convenient loading with loose ammunition, while the weapon lies horizontal," &c.

94. For an *Improvement in Brushes for Dressing Warps;* Samuel Taylor, Cambridge, Massachusetts.

Claim.—" My improved warp dressing brush, as made with the external ends of its bristles cut slantwise, or leveled with respect to their stocks, for the purpose of enabling the warps to centre the brush with more facility than should be the case were the points cut off square, in the usual way."

95. For an *Improved Water Wheel;* John Tyler, West Lebanon, New Hampshire.

Claim.—"1st, Giving the head of my improved water wheel an upward curvature from centre to circumference. 2d, The peculiar shape and position of the series of buckets within the wheel, viz: the convex surface of each bucket having the shape of the segment of a circle, whose radius is one-third longer than the radius of the wheel, whilst the said buckets are so arranged, that the convex surface of each bucket is tangential to an imaginary circle, whose centre is the centre of the wheel, and whose radius is one-third the length of the radius of the wheel. 3d, Also, connecting the lower edges of the buckets to each other, by means of a scolloped ring, of such a shape that the water will be conducted from the scroll-shaped water way, directly against the central portion of the convex surfaces of each bucket, and then pass freely downwards between the buckets."

96. For an *Improved Turning Machine;* Elbridge Webber, Gardiner, Maine.

Claim.—" The arrangement of the frame containing the pattern and turning centres, relative to the gauge rod and cutter carriage, whereby the said frame may be fixed, and the carriage movable, or the reverse, so that a fac-simile or a reverse pattern may be used, without any change in the machine."

97. For an *Improvement in Raking Attachment for Harvesters;* C. Wheeler, Jr., Poplar Ridge, New York.

Claim.—" The disk, with teeth attached, and gearing into a pinion in the shaft of the pulley, in combination with the cam, rod, and guides or ways, between which the slide, to which the rake is attached."

98. For an *Improved Hand Printing Press;* Daniel K. Winder, Cincinnati, Ohio.

Claim.—" The arrangement of the distributor and inking roller to the platen, and the said distributor actuated by the lever and link only when said lever is made to actuate the vibrating shaft, when said shaft is provided with the cams for pressing down or operating the platen."

99. For an *Improvement in Machinery for Cleaning the Top Flats of Carding Engines;* Horace Woodman, Biddleford, Maine.

Claim.—" 1st, The arrangement of gears on the cleansing frame, and in combination therewith, the studs or pins on the inner sides of said gears, and the levers, and the sliding bars, operating together with the slotted or corrugated arches or flanches. 2d, The said slotted or corrugated arches, whether cast with the main frame of the card or attached thereto; and this I claim, as a means of holding the cleansing frame in place, while the top cards are raised, stripped, and depressed, and also, as a means of regulating the reciprocating movements of said traverse or cleansing frame, from one side of the card to the other, and also from one card to any other. 3d, The combination of the lever and stripping rod, with its dogs and sliding clutch, arranged to reverse the motion of the cleansing frame. 4th, The arrangement of the waste pan, with a narrow bar and strip of filleting attached to the front edge of the pan, so placed as to remove the waste from the cleansing bar, to produce a clean brush bar for the cleansing of each top card."

100. For an *Improvement in Knitting Machines;* James B. and Walter Aiken, Assignors to Herrick and Jonas B. Aiken, Franklin, New Hampshire.

Claim.—" 1st, The hollow circular needle plate, having grooves cut in its inner surface. 2d, The horizontal groove near the bottom of the cone, so arranged in relation to the inclined operating groove, that the needles may be retreated thereto, and retained therein, when they are not wanted to operate on the fabric knit. 3d, The switch, arranged to change the needle from the inclined operating groove to the retreating groove."

101. For an *Improvement in Jacquard Looms;* John Goulding, Worcester, Mass.; patented in England, Nov. 22, 1855.

Claim.—" 1st, The combination and arrangement of the mechanism for operating the suspension and trap boards in jacquard looms, that is to say: lever, sector, or shaft pulley on shaft, connected by a chain or belt having slots, suspension, and trap board, connected to the lifting rods by arms. 2d, The lever, or its equivalent, operated by the tappets, or their equivalents, so arranged as to lock the beams or straight and ground warps. 3d, The mode of giving tension to the warp threads or yarn taken from bobbins, as shown by drawing it against itself or the bobbin or yarn which remains upon it by means of a weight, or its equivalent, but so arranged as to be lifted by the yarn when it is drawn, and release the bobbin, and allow it to turn until the yarn delivered permits the weight to descend again, and stop the bobbin by the friction of the weighted yarn against it. 4th, The traversing board, or its equivalent, arranged upon the knot cords or pile, or figuring harness below the warps, to bring down any single cord which may catch accidentally, so as not to be brought down by its own weight. 5th, Holding the parting by hanging them to a rod in rear of the heddles, and passing them between the upper and lower loops of the heddles. 6th, The trap boards pierced in the manner combined with needles. 7th, The thimble or socket, or its equivalent, for receiving, stopping, and holding the shuttle in the box. 8th, The apparatus for holding and drawing up the filling or binding weft, for the purpose of tightening the selvage. 9th, The arm to carry the weft thread from the fell at the edge of the cloth, nearly to where the pile warp crosses or makes an angle with the shed. 10th, I am aware that a knife, revolving on an endless belt, has been used: I, therefore, do not claim this feature, but I claim the application of the knife, in combination with its guides."

102. For an *Improved Automatic Cannon;* Charles E. Barnes, Lowell, Mass., Assignor to self, and Moses W. Oliver, Manchester, N. H.

Claim.—" The arrangement by which I impart a reciprocating and intermittent motion to the breech pin by gears, so that the gun or cannon may first receive the cartridge, bringing the nipple on which the percussion cap is placed in the centre, and immediately back of the end of the cartridge, ready for firing. Also, giving the ramrod plunger a reciprocating and intermittent motion for placing the cartridge within the gun, and firing it when so placed, by means of a hammer in the plunger, operated by spring and latch. Also, the cap-wheel and its slide rods, so arranged and operated, as to place or deposit the cap upon the nipple when the breech pin is drawn back, so that it can then be advanced or slid into the gun with the cap placed on the nipple therein, ready for firing. Also, the cartridge box, so arranged and operated by the breech pin, or otherwise, as to deposit the cartridge into the receiver, ready for the plunger or ramrod to force it into the bore of the gun. Also, the catch, or its equivalent, on the latch or otherwise, formed, arranged, and operated to stop the movement of the firing apparatus, to prevent accidents, and clogging the cannon with surplus ammunition."

103. For an *Improved Base Damper for Melodeons, &c.;* Riley Burditt, Assignor to Jacob Esley and Hartsel P. Green, Brattleboro', Vermont.

Claim.—" The base damper, applied under or within the swell, in combination with the lever and spring, so that it may be opened at the pleasure of the player, or remain closed while the swell is opened."

104. For an *Improved Mode of Constructing Dams;* Waldo P. Craig, Assignor to self, and Wm. R. Rightor, Newport, Kentucky.

Claim.—" The construction and application of the follower piles, each pile being formed from a plank having tapering sides and parallel edges, with a slanting termination at the thin end, running to one end, and chamfered on each side of the slant, and with the batten, or its equivalent, pointed from both edges, and chamfered from its outer side, one edge of the batten projecting beyond the longer edge of the pile, so as to form a rebate, fitting and over-lapping the edge of the preceding pile."

105. For an *Improvement in Cooking Stoves;* Henry S. George, Assignor to self and George Gratton, Syracuse, New York.

Claim.—" The arrangement of the air flues, through and around the fire chamber, and the hot air channel between the oven plates and the passage for the products of combustion, with the dampers for supplying the fire draft with hot air."

106. For an *Improvement in Sounding Guards for Vessels;* John Guest, U. S. N., Washington, D. C.

Claim.—" The mechanical construction of the machine, and especially the attachments of the radius bars, working in the grooves, by which I am enabled to indicate the approach of shoal water, whether the vessel be going ahead or astern."

JULY 15.

107. For an *Improved Straw Cutter;* Warren S. Bartle and Ebenezer Vaughan, Newark, New Jersey.

Claim.—" The mode of operating the knife, by means of the lever and secondary pitman, in combination with the knife and main pitman ; by which a variable downward drawing stroke is effected."

108. For an *Improvement in Ploughs;* Alvin Barton, Syracuse, New York.

Claim.—" Jointing the upper and front points of the body of the plane to the coulter."

109. For an *Improvement in Corn Planters;* M. Bemis, Lyme, Ohio.

Claim.—" Arranging the frame upon the axle and wheels, and connecting the point of draft behind and below the axle, and in combination with the arm and pins."

110. For an *Electro-Magnetic Fog Bell;* A. Barbarin and B. F. Simms, New Orleans, Louisiana ; patented in England, August 17, 1855.

Claim.—" The application of electricity and magnetism to the ringing of fog bells."

111. For an *Improvement in Means for Controlling Feed-water Apparatus of Steam Boilers;* Benjamin F. Bee, Wareham, Mass.

Claim.—" Controlling the feed-water apparatus of steam boilers by the float, and the intermediate means, or their equivalents, between it and the feed-apparatus, and connected with the counter balance, or not."

112. For an *Improvement in Nutmeg Graters;* George Blanchard, City of New York.

Claim.—" The application and arrangement of the self-sliding grater, in connexion or inside of the hollow cork-screw handle or tube, so that when the whole structure is shaken with one hand, the nutmeg is grated by the sliding grater."

113. For an *Improvement in Rope Machines;* Thomas G. Boone, Brooklyn, N. Y.

Claim.—" 1st, The arrangement of the strand spindles, with their axis all in the same line with each other and with the axis of the laying spindle—whereby I am enabled to put in a forehard equal in turn to that of the lay, without rotating the strand spindles. 2d, The arrangement of gearing, whereby, during the rotation of the laying spindle, the strand spindles may be kept stationary, or have a slight rotary motion imparted to them, either in the same or in a contrary direction with the laying spindle ; consisting of the stationary gear, the shafts with their gears, and the gears on the strand spindles. 3d, The conducting tubes furnished with rollers, or their equivalents, revolving around the axis of the laying spindle and spool spindles, and rotating at the same time on their own axis, operating in continuation with the arrangement of strand spindles, to take out the first additional twist received by the strand, and carry it forward to produce a forehard in the rope."

114. For an *Improved Method of Turning Ornamental Forms;* P. C. Cambridge, Jr., Enfield, New Hampshire.

Claim.—" The sliding carriage with tools attached to it—the carriage being fitted transversely on a carriage. Also, the carriage, in combination with the collar and cutters, when the above parts are placed on the carriage. Also, the polygonal notched bar or gauge rack, by which the movement of the carriage is regulated, according to the character or nature of the work to be done, and the stuff beaded in the desired manner."

115. For an *Improved Marble Sawing Machine;* Ira Carter, Malone, New York.

Claim.—"Giving the saws a lateral vibrating motion while the saw frame or gate is being operated, by means of the rods attached to sliding frame, in combination with arms, levers, and racks."

116. For an *Improved Machine for Striking Unburnt Brick;* Marinus P. Crapo, Humboldt County, California.

Claim.—"Operating the follower and striker."

117. For an *Improved Self-Setting Tail Block for Sawing Mills;* Joel Dawson, Barnesville, Ohio.

Claim.—"The bent or curved lever, with pawl secured to it, adjustable block with the screw and oblique board attached, and the sliding block with rack secured to it."

118. For an *Improvement in Fire Backs for Fire Places;* Samuel M. Echols, Lafayette, Indiana.

Claim.—"Dividing the spindle diagonally, and providing a screw-hole in one end of each of its sections, at right angles to the division line."

119. For a *Straw Cutter;* Cotton Foss, Painesville, Ohio.

Claim.—"The stationary arm, friction roller, and inclined track."

120. For an *Improved Cutting Device for Harvesters;* Carlos W. Glover, Roxbury, Connecticut.

Claim.—"The oscillating or rocking cutters placed within the fingers, and used in connexion with the sickle."

121. For an *Improved Stone Dressing Machine;* A. M. George, City of New York.

Claim.—"An improvement on the stone dressing machine of Nichols & George, patented December 18, 1855. Also, the toggle, with the rollers and knives or cutters attached, in combination with the rotating shafts, with the adjustable arms upon them."

122. For an *Improved Collodeon for Photographic Pictures;* Victor M. Griswold, Lancaster, Ohio.

Claim.—"The addition of albumen to collodion."

123. For an *Apparatus for Slaughtering Hogs;* Thomas J. Godman, Madison, Ind.

Claim.—"The horizontal revolving wheel or frame, provided with hooks on its periphery, arranged at or near the scalding bench, and used to transport and transfer the hogs from the bench (on which they are deprived of their hair by pulling and shaving,) to the scraper down gutter washer out of the inside: and off-beams, which hang them in the drying room, holding the hogs convenient to each laborer in succession, a proper time for him to perform his allotted or respective portion of the slaughtering process."

124. For an *Improvement in the Frames of Mowing and Reaping Machines;* Moses G. Holland, Penn Yan, New York.

Claim.—"The cylindrical conical formed metallic frame, as a support for the running gear and finger bar, when constructed, arranged, and combined therewith. Also, in combination with said cylindrical or conical metallic frame, the step or brace frame."

125. For an *Improvement in Railroad Car Wheels;* A. C. Ketchum, City of N. York.

Claim.—"Connecting the hub and rim of the wheel by fitting a flanch attached to the hub, within a flanch attached to the rim, providing the said flanch with a shoulder and groove, and applying a divided clamping ring to the said groove."

126. For a *Machine for Composing and Distributing Type;* Julius J. Koenig, Chicago, Illinois.

Claim.—"The arrangement of parts, for the purpose of composing and distributing type."

127. For a *Mode of Tinting Photographic Pictures;* Giles Landell and Marcus A. Root, Philadelphia, Pennsylvania.

Claim.—"The application of coloring substances or matter, to photographic impressions or pictures upon glass or metal, or other material."

128. For an *Improved Straw Cutter;* Oren Moses, Malone, New York.

Claim.—"Constructing the auxiliary cylinder of an iron skeleton, combined with fillings of wood, horn, or other suitable material, when the shaft of said cylinder is secured to its driving pinion in such a manner, that the relative position of the cutting cylinder and the auxiliary cylinder can be so adjusted, as to cause the edges of the knives in the former to act equally and uniformly upon every portion of the face of each of the fillings in the latter cylinder, for the purpose of preventing the formation of deep channels in said fillings."

129. For an *Improved Sash Lock;* Lucius Paige, Cavendish, Vermont.

Claim.—"The combination and arrangement of the weighted arm, the rack, the sectoral gear or pinion, the stopping arm, and the stop shoulder, as applied to the bolt and within the case thereof, and so as to operate together and actuate the bolt."

130. For an *Improvement in Ploughs;* John Rich, Kingsbury, New York.

Claim.—"The socket, when arranged and combined with the body of the plough."

131. For an *Improved Three-wheeled Pleasure Carriage;* Cyrus W. Saladee, Columbus, Ohio.

Claim.—"The longitudinal braces, in combination with the double circle, by which means the third wheel is firmly connected to the hind axle and wheels."

132. For an *Improvement in the Adjustment of Mill Stones;* J. G. Siemers, St. Louis. Missouri.

Claim.—"Supporting a stationary stone upon a series of elastic and readily adjustable bearings, when the said stationary stone is combined with a running stone, which rests upon a series of elastic and readily adjustable bearings, which are combined therewith, and with the spindle or shaft of the same, in such a manner, that the faces of said stationary and running stones are enabled to mutually self-adjust themselves to each other, and are also enabled to be adjusted."

133. For an *Improvement in Fire Arms;* George H. Soule, Jersey City, N. J.

Claim.—"The use of the facings of copper, or other equivalent tough metal, less oxidizable than steel or iron, by the action of the heat and sulphur gases caused by the explosion of the powder, in combination with the breech piece and charging chamber."

134. For an *Improvement in Making Seamless Metal Tubes;* J. J. Speed, Jr., and J. A. Bailey, Detroit, Michigan.

Claim.—"The three encircling and radially hammering or pressure dies when arranged relatively to each other, and operating together on the tubular ingot while stationary, and in combination with the intermittent feed to the ingot or partially formed tube on or over the mandrel, alternate with the compressive action of the dies."

135. For an *Improvement in Machines for Threshing and Cleaning Grain in the Field;* George W. Swift, Oxford, Mass.

Claim.—"The pinions and pulleys, in combination with the traveling wheels; the double axles and the pivoting attachment for giving the driving pulley an accelerated rotation, from the rotation of the traveling wheels, either by the forward motion of the machine, or by a circular motion about its attachment."

136. For an *Improved Cattle Stall;* Hiram Tarbox, 2d, Tremont, New York.

Claim.—"Having attached or supported an apron, or its equivalent, whereby the excrement is prevented from dirtying the animal, and also protecting litter or bed."

137. For an *Improvement in Detachable Shaft Coupling;* Peter Teal, Philadelphia, Pennsylvania.

Claim.—"The plate or ring, for the purpose of operating the coupling of the shafts and also for releasing the coupling."

138. For an *Improvement in Mop Heads;* Hiram Thompson and Richard Q. Tuson, Lebanon, New Hampshire.

Claim.—"Firmly securing the binder in any desired position by the joint action of the cam lever and the spring, when the former is combined with the hinder ring, and the latter with the mop handle."

139. For an *Improved Washing Machine;* H. H. Torrey, Buffalo Grove, Illinois.

Claim.—"The rotating reciprocating disk, placed within the tub and upon the arbor or shaft, when said disk is provided with pins or pegs on its under surface, and the bottom of the tub with radial rubbers."

140. For an *Improvement in Mowing Machines;* John W. Thompson, Greenfield, Massachusetts.

Claim.—"Connecting the cutter plate box to the after ends of freely vibrating arms, in combination with the rectangular frame and the inwardly projecting and sustaining arm, when the said parts, together with the cutter plates and their gearing, are arranged in relation to the main wheel."

141. For an *Improvement in Car Coupling;* John B. Witherle, Upton, Mass.

Claim.—"Applying the sliding retracter and the curved graspers together, so that the fulcrum of the latter shall be movable with the retracter, and the whole be made to operate in other respects."

142. For an *Improvement in the Mode of Regulating the Conical Pendulum of Time Keepers;* John C. Briggs, Concord, New Hampshire.

Claim.—"The application of friction to conical or rotary pendulums, to keep them revolving very nearly in any desired circle."

143. For an *Improved Mode of Charging Cannon;* Josiah Dodge, Dummerston, Vt.

Claim.—"The arrangement of the spring, guide pin, openings, and forked lever, for the double purpose of revolving and guiding the tubing on the periphery of the wheel to the ends of the cannon barrel."

144. For an *Improved Printer's Composing Stick;* Oliver F. Grover, Middletown, Connecticut.

Claim.—"The application to the composing stick of the guide, to prevent the slide and the bed from separating while adjusting the composing stick, and the clasp to secure and hold the slide in its place when adjusted; using for that purpose the aforesaid guide and the clasp."

145. For an *Improvement in Centrolineads;* W. Jose von Kammerhueber, Washington, D. C.

Claim.—"The combined T square and centrolinead, in connexion with the circular arcs of different diameters, and of any suitable material, provided on their ends with pins, or their equivalent, to secure them to the drawing board, when used to guide the centrolinead."

146. For an *Improvement in Preparing Vegetable Dye-Stuff;* Frederick E. Schmidt, City of New York.

Claim.—"The treatment of the juice previous to its use for dyeing, to produce permanent and durable colors."

147. For an *Improvement in Fenders for Fire Places;* John W. Truslow, Lewisburg, Virginia.

Claim.—"The hinged folded screen or fender, within the recess in the jambs, in combination with the spring in rear of the screen, and the sliding panel in front of the same."

148. For an *Improved Filtering Medium;* Wm. Wickersham, Boston, Mass.

Claim.—"1st, The use of the disk in water filters, formed of flattened wire or narrow strips of metal, grooved transversely by either milling or engraving, in such a manner, that when said strips are formed or wound into a disk, said grooves will form apertures for the water or other fluids to pass through said disk in the process of filtering. 2d, The method of making the filter disk less liable to injury, and more firmly, by inserting pins rom the edge to or nearly to the centre through the different layers of metallic strips of which it is made, to hold them in their places; this method of fastening the disk together I claim, only in combination with the spiral filter disk."

149. For an *Improvement in Lard Lamps;* J. S. Senseny, Assignor to self and G. H. Merklein, Chambersburgh, Pennsylvania.

Claim.—"The arrangement and construction of a lamp."

JULY 22.

150. For *Improved Cutter Heads for Planing Machines;* Lewis M. Berry, Boston, Massachusetts.

Claim.—"The application and use of the pieces."

151. For an *Improved Mode of Attaching Sleigh Bells to Straps;* Abner G. Bevin, Chatham, Connecticut.

Claim.—"Making the bell without shanks, and having holes made through them to receive the staples which pass through the straps and cover."

152. For an *Improvement in Door Knobs;* Jeremy W. Bliss, Hartford, Conn.

Claim.—"The employment of the intermediate piece, having a cut or racked surface, corresponding to and secured upon the spindle by the set screw at any desired point."

153. For an *Improved Method of Driving Circular Saws;* John Broughton, Chicago, Illinois.

Claim.—"The sliding frame, placed and working between the horizontal and segment guides or ways in the frame—the frame having the saw placed within it, and driven by the belts from the shaft, arranged relatively with the frame."

154. For an *Improvement in Fixed Cartridges;* George Buckel and Edward Dorsch, Monroe, Michigan.

Claim.—"1st, The arrangement side by side in the same cartridge, and with their axes in the same circle, of a number of balls of cylindro-conoidal, or other partly cylindrical form, said balls being of a size to fit each to a separate groove of a circular grooved barrel. 2d, The employment of a single partition piece, to separate each and all of the balls, for the prevention of their union by fusion, when the charge explodes."

155. For an *Improvement in Percussion Tape Primers;* James Chattaway, Springfield, Massachusetts.

Claim.—"The improvement of substituting for paper, metal hermetically sealed, and soldering of the continuous band, so as to make it impervious to water, weather, or climate."

156. For an *Improvement in Vibrating Steam Engines;* William Darker, Jr., West Philadelphia, Pennsylvania.

Claim.—"The oscillating piston, arranged within a steam box, which is provided with a partition and with suitable packing, and with a suitable arrangement of a valve or valves and passages, the whole operating in connexion with suitable means of converting the oscillating movement of the piston into a continuous rotary motion."

157. For an *Improvement in Artificial Hands and Arms;* John S. Drake, Boston, Massachusetts.

Claim.—"The ratchet and pawl in the elbow-joint, to sustain the fore arm at the proper position relatively with the stump. Also, the construction of the wrist-joint with the slots and stops for allowing the necessary motion. Also, forming the knuckle joints and the joints between the different parts of the fingers and thumb with ratchets and pawls, so as to secure said joint at the point to which they may be moved in adjusting the fingers or thumb to any given article or purpose. Also, disengaging the pawls from their respective ratchets, by means of the sliding cross-bar, (actuated by competent power,) rods, and cam pieces. Also, the arrangement of the bars, crank, button, and rod, for actuating the bar and rods. Also, in connexion with this arrangement, the cross lever for actuating the bar pawl of the thumb."

158. For an *Improvement in Self-Acting Electric Telegraphs;* Moses G. Farmer, Salem, Massachusetts.

Claim.—"1st, The method of arresting the motion of the type wheel, by means of the alternately open and closed keys, in combination with the circuit wheel. 2d, The combination of a straight key board with a circuit wheel, when the two are connected together by means of the wires, whereby the place of making and breaking the circuit may be transferred to the immediate vicinity of the key board. 3d, The method of putting the two machines in correspondence with each other, the current being turned out of the operating magnet of the receiving machine, by means of the regulating key, the arm, insulated spring, and their connexions."

159. For an *Improved Machine for Moulding and Pressing Building Blocks from Clay, &c.;* Ambrose Foster, City of New York, and George M. Foster, Fairhaven, Connecticut.

Claim.—"1st, The sliding hopper, plunger, and vibrating press box, when the above parts are moved or operated relatively with each other. 2d, Operating the hopper, press box, and plunger, by means of the cam on the shaft, the ledgers on the wheel, and levers."

160. For an *Improvement in Machines for Felting Hat Bodies;* Lansing E. Hopkins, Brooklyn, New York.

Claim.—"1st, The combination of the beaters, the revolving belt, and the beater heads. 2d, The adjustability of the beater heads, in combination with beaters having a positive motion."

161. For an *Improvement in Gas Stop-Cocks;* James Humphrey, Boston, Mass.

Claim.—"The mercurial gas-cock, constructed with the adjustable slitted cylinder and the reservoir of mercury."

162. For an *Improvement in Harvesters;* Stephen Hunter, Cortlandt, New York.

Claim.—"The employment or use of the rotating cutters formed of circular plates, with teeth at their peripheries—said teeth working through or between slotted fingers on the plates, when such plates are connected by a hinge or joint, and attached to the frame."

163. For an *Improved Fly-Trap;* Joseph Hyter, Kent, Indiana.

Claim.—"A trap for catching flies, having an opaque front and bottom inclined transparent back, small front decoy passage, grooved bait board and trough."

164. For an *Improved Cutter Stock for Metal Planers;* Joshua Mason, Paterson, New Jersey.

Claim.—"The cutter stock placed within a ring or band, which is suspended by journals within the frame or box—the stock being provided with a sliding or adjustable plate, provided with a slot, and the stock adjusted or operated at the end of each stroke of the bed, by the pins on the side of the bed, and the levers."

165. For an *Improved Machine for Sawing Stone or Marble;* Matthew J. McBird, Logansport, Indiana.

Claim.—"The combination of the turn table and the lateral moving platform or bed, so that when the turn table is revolved the stone or marble will be brought in oblique position under parallel moving saws, while the platform or bed, when that is given a lateral transverse movement to the parallel position of screws, the stone or marble is given a corresponding movement and brought to the position required."

166. For an *Improvement in Cotton Gins;* James B. Miles, Chicot, Arkansas.

Claim.—"The arrangement of the swing board, in combination with the mechanism described, so that the varying size of the roll of cotton in the gin shall govern the feed, and keep it uniform, or nearly so."

167. For an *Improved Polishing Machine;* John Moore, Gardiner, Maine.

Claim.—"The general construction of the machine, having a rubber revolving by power, and so constructed as to be readily applied whilst in motion to all parts of the work as required."

168. For an *Improved Marble Sawing Machine;* John M. Mott, Jr., Lansingburgh, New York.

Claim.—"The use of the adjustable guide bars, guide rods, and slides on the guide bars, or their equivalents, in combination with the slides carrying the saws."

169. For an *Improved Re-acting Water Wheel;* A. Monroe, Worcester, Mass.

Claim.—"The scroll, having the guide or deflecting plates attached to it, the wheel, provided with the concave buckets, and the plates attached to its arms."

170. For an *Improved Method of Tapping Fluids under Pressure;* James P. S. Otterson, Nashua, New Hampshire.

Claim.—"1st, The employment of a chamber of sufficient capacity to contain the cock, together with the necessary tools for inserting the same in any pipe or vessel containing water under pressure. 2d, The employment of the rotary plate, or its equivalent, working in or forming part of the chamber."

171. For an *Improved Valve for Type Casting Machines;* Edward Pelouze, Jr., Philadelphia, Pennsylvania.

Claim.—"In combination with the nipple, the self-acting valve and stoppers."

172. For an *Improved Self-Raker for Harvesters;* Silas G. Randall, Rockford, Illinois.

Claim.—"The railway carriage, when constructed, arranged, and operated in respect to the platform. Also, the method of operating the rake, and giving it at once its transverse and its tilting actions, viz: by the combination with the bent rake shaft and arm of the endless belt and its eye. Also, the combination of the traverse rake, the spring, rods, and the pressing guards."

173. For an *Improvement in Repeating Fire Arms;* C. S. Pettengill, New Haven, Connecticut.

Claim.—"1st, In combination with the arrangement of the main spring to work on a pivot, so as to be capable of relief from all strain, except at the time of firing, the application to the said spring of a spring—operated upon it to draw back and effect the cocking of the hammer. 2d, In combination with the arrangement of the main spring to work on a pivot, I claim the lever and the cam on the trigger, operating together and upon the main spring, to strain and develop the elasticity of the main spring, by the act of drawing the trigger to fire. 3d, The sear as arranged, entirely disconnected from the trigger, and operated upon to set free the tumbler, by means of a cam on the trigger. 4th, The attachment of the dog which operates in the ratchet notches on the cylinder to the same lever by which the strain is thrown on the main spring. 5th, The arrangement of the slot in the recoil shield, and the holes at the end of the ratchet notches on the cylinder—whereby the cylinder is locked so as to be incapable of rotation in either direction, before the hammer is let off."

174. For an *Improvement in Glass Furnaces;* Samuel Richards, Philadelphia, Pennsylvania.

Claim.—"1st, The employment of a series of interior tubes. 2d, The employment, in connexion with said tubes, of vibrating or rotating agitators."

175. For an *Improved Scaffold for Shingling Roofs;* J. W. Rodefer, Abington, Va.

Claim.—"Constructing the scaffold, viz: having the platform hinged to the sleepers or string pieces, and having segment braces attached to the sleepers or string pieces; the braces having holes made through them and passing through the bars of the platform, whereby the platform, by means of pins passing through the holes in the braces, may always be adjusted in a horizontal position, whatever the pitch or inclination of the roof may be."

176. For an *Improvement in Liquids used as a Motive Power;* John C. fr. Solomon, Baltimore, Maryland.

Claim.—"The sulphoil carbonic acid liquid, prepared in combination with carbonic acid, generated in any known way, or other equivalent liquifiable gas as a motive power."

177. For an *Improvement in Riding Saddles;* John C. fr. Solomon and Geo. E. Cooper, Baltimore, Maryland.

Claim.—"The movable volute spring seat, with its guiding rods, and the guides in which the same is moved on the upper sides of the pads, in combination with the supporting rod attached to the underside of the metallic riding seat."

178. For an *Improved Friction Match Machine;* C. D. Smith and H. Patterson, Baldwinville, Massachusetts.

Claim.—"1st, The table, with its plate and pieces, or their equivalents, to carry the splints from the dies, and place them in the rack. 2d, The peculiar construction of the rack pieces to facilitate their receiving splints, and for the better control of them."

179. For an *Improved Arrangement of Means in Pendulum Pumps for Ships;* J. Stever, Bristol, Connecticut.

Claim.—"Attaching a series of pumps to a hollow shaft, which is allowed to turn freely in its bearing, and connecting the weighted bars to the plunger rods of the pumps, by means of the geared sectors and levers."

180. For an *Improvement in Sewing Machines;* A. Swingle, Assignor to Elmer Townsend, Boston, Massachusetts.

Claim.—"The employment of a hook, in connexion with the looping needle, and arranging said hook so that it shall pass into the cloth or material from the same side of it which the looping needle works on is situated."

181. For an *Improved Trigger Protector for Fire Arms;* Bernard H. Westerhood, Philadelphia, Pennsylvania.

Claim.—"The employment, in connexion with fire arms, of a protector, which can be locked so as to entirely enclose the trigger, and opened so as to expose the same."

182. For an *Improved Method of Riving Equal Pieces from a Block;* Henry White, Oneida Castle, New York.

Claim.—"Traversing the block to be split, so that the froe will strike the pieces to be split in the centre, successively to split them. Also, the springs, so applied as to yield when the froe enters the block, and re-act to close the split, when the froe is withdrawn."

183. For a *Machine for Sawing Coopers' Hoops;* James O. Woodward, Taunton, Massachusetts.

Claim.—"The arrangement and operation of two circular saws for sawing irregular or crooked hoop poles—and the two shafts with the saws attached at the inner ends thereof, being placed on an angle, so that two edges of said saws run or operate near together, and the two opposite edges of said saws will run or operate wide apart."

184. For an *Improvement in Relieving Steam Slide Valves from Pressure;* Henry R. Worthington, Brooklyn, New York.

Claim.—"The transferring of steam pressure from the back of a steam slide valve to a fixed point by means of a piston and vibrating link."

185. For an *Improvement in Valves of Accordeons;* C. M. Zimmermann, Philadelphia, Pennsylvania.

Claim.—"The arrangement of the valves of the instrument, in connexion with sliding rollers acted upon by the keys and regulated by stops, for the purpose of producing from the actuating of one key, a variety of different tones, by the simple pressure of the stop."

186. For an *Improvement in Folding Guides of Sewing Machines;* B. C. Boyes, Assignor to self and H. Dercum, Philadelphia, Penna.

Claim.—"The employment of one or more helical or split rings, for the purpose of forming on the edges of fabrics single or double hems, or for forming plaits in the middle of fabrics, previous to the said hems or plaits being submitted to the action of the needle and thread of sewing machines."

187. For an *Improved Planing Machine;* Asahel Lockwood, Chicago, Illinois, Assignor to L. B. Flanders, Cleveland, Ohio.

Claim.—"The support, with its circular dovetail grooves, or their equivalents, attached to the bed piece, together with the vibrating table turning upon the centre pin or king bolt, and in combination therewith, the adjustable guide and the sliding head, so adjusted and combined, that a greater or less vibratory motion can be secured to the table, by means of the adjustable guide, by bringing it out of a parallelism with the ways and the bed."

188. For a *Machine for Sewing Pins upon Paper or any other material;* E. S. Woodward, Winchester, Connecticut, Assignor to James R. Keeler, City of New York.

Claim.—"The roller or separator, made of india rubber or other elastic substance. Also, the turn-table, for receiving and changing the pin from one place or position to another, or their mechanical equivalents. Also, the combination of one or a series of conductors for supplying pins in any desirable position, and a sewing machine of any suitable adaptability for sewing pins upon paper or any other material."

189. For an *Improvement in Chairs;* James Fernald, Boston, Mass.

Claim.—"The oval back rest, or its equivalent, when made to rotate."

MECHANICS, PHYSICS, AND CHEMISTRY.

*The Gums and Resins of Commerce.** By P. L. Simmonds.

(Continued from page 127.)

Mezquite Gum.—Attention has recently been called in the United States to the discovery, in great abundance, of a species of acacia, known as the mezquite tree, which furnishes large quantities of gum, nearly equal to the gum arabic of Africa. It will no doubt prove a valuable source of revenue to the State of Texas, New Mexico, and the adjacent Indian territory, besides affording employment to the different tribes of Indians, now roving upon the plains, many of whom would be glad to gather and deliver it to the different frontier government posts for a very small compensation.

The mezquite is by far the most abundant tree of the plains, covering thousands of miles of the surface, and always flourishes most luxuriantly in elevated and dry regions. The gum exudes spontaneously in a semi-fluid state from the bark of the trunk and branches, and soon hardens by exposure to the atmosphere, forming more or less rounded and variously-colored masses, weighing each from a few grains to several ounces. These soon bleach and whiten upon exposure to the light of the sun, finally becoming nearly colorless, semi-transparent, and often filled with minute fissures. Specimens collected from the trunks of the trees, were generally found to be less pure and more highly colored than when obtained from the branches.

The gum may be collected during the months of July, August, and September; but the most favorable period for that purpose is in the latter part of August, when it may be obtained in the greatest abundance, and with but little trouble. The quantity yielded by each tree varies from an ounce to three pounds; but incisions in the bark not only greatly facilititate the exudation, but cause the tree to yield a much greater amount. As it is, a good hand will probably be able to collect from ten to twenty pounds in a day. Were incisions resorted to, double the amount might be obtained.

A simple, pure gum, was recently shown at Madras, obtained in Travancore, from the *Macaranga indica*, which has been used for taking impressions of leaves, coins, medallions, &c. When the gum is pure and carefully prepared, the transparent impressions are as sharp as those of sulphur, without its brittleness. The exudation appears to be an entirely unknown production.

Keekur gum, a variety of Arabic, is produced by *Vachillia farnesiana.*

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*From the Journal of the Society of Arts, Lond. November, 1855.

Acacia Sirissa in India yields a large quantity of a clear gum known as Dirisani gum, and closely resembling Keekur gum. Booraga, obtained from *Bombax malabricum*, is a pure gum.

TRAGACANTH is a gummy exudation, obtained from various species of *Astragulus ; A. verus* (Olivier), *gummifera creticus* (Lamarck), which is imported for medicinal purposes from Smyrna and other ports in the Levant, to the extent of about five or six tons per annum. It is obtained principally from Northern Persia, Asia Minor, and America. Hamilton (Researches in Asia Minor, &c.) states that tragacanth, which is called by the Turks "kittereh," is collected in large quantities in the hills about Buldur, from a low prickly plant, resembling a species of furze. The white flaky gum is obtained by making an incision in the stems near the root, and cutting through the pith, when the sap exudes in a day or two and hardens in the opening, after which it is collected by the peasants. Its price there was about 3*s*. 2*d* per lb.; 23 tons were imported in 1850 from Smyrna, and the imports have since annually increased, until in 1853 they reached nearly 70 tons.

A spurious tragacanth is obtained in the East from the *Sterculia urens* and *S. fœtida*, and an inferior tragacanth is also procured from *Cochlospermum gossypium.*

Leaving the true gums, we come now to the RESINS. These are either natural exudations or are obtained from some vegetable compounds by the aid of alcohol, in which they are generally soluble, although totally insoluble in water. They are for the most part brittle, tasteless or insipid, fusible at a moderate heat, soluble in the fixed and volatile oils, and some in the muriatic and acetic acids. They have no smell, except when they retain a portion of volatile oil, in which case they partake of the smell and acid taste of that oil. Resins generally burn with a strong yellow flame, emitting at the same time a vast quantity of smoke. Dammer affords a good example of the resins.

It is strange that of the origin of substances at once so valuable and so familiar to us so little should be known. The sources of the dammer and many of the wood oils from Singapore and the Eastern Archipelago are little known, nor are the copals, the anime, the myrrhs, and other valuable gums and resins from Africa, Zanzibar, &c., well defined.

COLOPHONY, the ordinary resin of commerce is the residuum remaining in the body of the still after common turpentine has been submitted to distillation for the manufacture of the oil of turpentine of commerce, or spirit of turpentine. The black resin, or colophony is the cooled brittle mass in the state in which it leaves the still ; the amber or yellow-colored, is the same resin mixed with about one-eighth part of water while it is yet fluid.

Large quantities of resin oil, or pine oil, as it is generally called, are made in the metropolis and in the neighborhood of Liverpool, Hull, Bristol, and Glasgow, and it is employed in the manufacture of grease for lubricating the bearings of heavy machinery, and the axles of railway wagons, &c. It is much used in France for the manufacture of printing ink, and hence a principal source of the unpleasant odor of some of the French newspapers. About 23,000 tons of rosin are annually imported, of which the bulk comes from America, and a little from the Hanse Towns.

One of the most important oleo-resins in a commercial point of view is turpentine, of which we import from 17,000 to 25,000 tons per annum, almost exclusively from the United States. The comparative receipts in the last nine years have been as follows:—

	Tons.		Tons.
1846, .	17,897	1851, .	21,790
1847, .	16,193	1852, .	24,080
1848, .	20,089	1853, .	19,650
1849, .	20,566	1854, .	17,038
1850, .	21,731		

In the State of North Carolina, about 800,000 to 1,000,000 barrels of turpentine are now annually made, giving occupation to about 5000 laborers in making it, and perhaps three time as many more human beings are supported mainly from the proceeds of its first sale. There are about 200 stills in operation there. The income of North Carolina from her pineries alone must reach half-a-million sterling.

The multifarious uses of the pine tree seem to augment with the development of the inventive talent and ingenuity of the age. Manufacturers already extensively use it in various processes. The painter draws deeply upon the turpentine to paint the four million of dwelling houses in Great Britain, and the same number in the United States, besides the carriages and other vehicles. That great lever of public opinion, the press, could not put forth a printed page without it. Turpentine to the value of £50,000 or £60,000 is annually consumed in America by the India rubber manufacturers. The new process of lighting up houses and whole cities with rosin-gas in America is consuming every barrel made, and has greatly raised its price there. The soap-maker, too, has long used it, and could not now dispense with it.

A liquid resinous exudation known as Chiam or Cyprus turpentine is obtained from Syria and the Greek Archipelago from *Pistacia Terebinthus.* The trunks of the largest trees are cut across with a hatchet and the turpentine runs down on flat stones placed for the purpose, where it hardens. The quantity obtained from each tree is only about eight or ten ounces.

The coniferous trees of Europe and America furnish the turpentine, tar, and pitch of commerce, especially in Europe, *Pinus Sylvestris*, and *P. Pinaster.*

The swamp or long-leaved pine supplies the chief portion of the turpentine, tar, &c., consumed in or exported from the United States. *P. Tæda*, abundant in Virginia, yields common turpentine, but of a less fluid quality than that which flows from the preceding species.

The resins are chiefly used in making varnishes and lacquers, for several purposes in dyeing, for sealing wax, and for ornamental house papering.

Varnishes may be divided into three classes, spirit varnishes, volatile oil varnishes, and fixed oil varnishes. The first class are easily prepared and applied, dry quickly and are free from unpleasant smell; they are used for articles of furniture and musical instruments.

The resins which enter into their composition are seedlac, benzoin, anime, or thus. The varnishes made with essential or volatile oils are chiefly used for pictures—caoutchouc, and oil of turpentine, (turps, as it is familarly termed,) enter into their composition. Fixed oil or fat varnishes—dry easily—at common temperatures, and form a solid and nearly colorless glazing suited for coach panneling and house painting.

The fine copal varnishes do not dry so readily as if mixed in the proportion of three parts of anime and one of copal. Oil varnishes require to be kept a considerable time to ripen, as it is technically termed, before they are fit for use, the time varying from three to twelve months, according to the purpose for which they are intended, in order that the driers and other feculencies may be deposited and the varnish become bright and transparent.

Varnishes are very extensively employed in the arts and for domestic purposes. When we consider the large number of vehicles in use of various kinds, the superior classes of which, as private coaches, omnibuses and cabs, railway carriages, and the paint-work of ships' cabins, houses, and household furniture, pictures, &c., all require varnish, we shall be able to form some slight idea of the consumption. The tenders for one railway company alone, the London and North Western, are for 1500 gallons at a time. Gold and bronze lackering, and varnish for stoves, &c., are other uses. The recent permission to use methylated spirit in the manufacture of varnish, free of duty, bringing down the price some 10*s.* to 12*s.* a gallon, will give even a further stimulus to the demand for resins, and probably lead to the more general employment of varnishes for wood-wook instead of paint.

According to Thunberg, the very best Japan varnish is prepared from *Rhus vernifera*, which grows in great abundance in many parts of that country, and is likewise cultivated in many places on account of the great advantages derived from it. This varnish, which oozes out of the tree on being wounded, is procured from stems that are three years old, and is received in some proper vessel. At first it is of a lightish color, and of the consistence of cream, but grows thicker and black on being exposed to the air. It is so transparent when laid pure and unmixed upon boxes or furniture, that every vein of the wood may be seen. For the most part a dark ground is spread underneath it, which causes it to reflect like a mirror, and for this purpose recourse is frequently had to the fine sludge, which is got in the trough under a grindstone, or to ground charcoal; occasionally a red substance is mixed with the varnish, and sometimes gold leaf, ground very fine. This varnish hardens very much, but will not endure any blows, cracking and flying almost like glass, though it can stand boiling water without any damage. With these the Japanese varnish the post of their doors, and most articles of furniture which are made of wood. It far exceeds the Chinese and Siamese varnish, and the best is collected about the town of Jesino. It is cleared from impurities by wringing it through very fine paper; then about a hundredth part of an oil called *toi*, which is expressed from the fruit of *Bignonia tomentosa*, is added to it, and being put into wooden vessels, either alone or mixed with native cinnabar, or some black substance, it is sold all over Japan. The expressed oil of the seeds serves for candles. The tree is said to be equally poisonous with the *rhus vernix* or American poison tree commonly called swamp sumach.

The varnish tree of the Burmese (*Melanorrhœa usitatissima*) is spread over a wide range of country, extending from Memipur, in lat. 25 N. long. 94 E., to Tavoy, lat. 14 N., long. 97 E. It attains its greatest size in the valley of Kubba, distance about 200 miles from the sea-shore. The trees average from 30 to 40 feet high, and have a circumference of from five to eleven feet, four feet above the ground. A good tree yields about 10 or 12 lbs. of varnish annually, and its value at Prome, on the Irawaddy, is about 10*d.* the pound; it is used in enormous quantities by the natives as a lacquer.

Dr. Wallich states that the natives never experience those deleterious effects from handling the varnish in its liquid state, which Europeans generally suffer; in its fresh state, it has very little pungency of taste, and is altogether devoid of smell. The natives are very apt to adulterate that brought to market with sesamum oil.

Wood Oils.—This class of resinous oils, known in all the Indian bazaars as gurgun oils, is obtained by tapping certain trees of the order Dipterocarpeœ (*D. lævis*, Hamilton; and *D. turbinatus*, of Roxburgh), and applying heat to the incision. The tree is a native of Chittagong, Pegu, Assam, the valley of Kubba, and the jungles of the Malayan peninsula, and grows to a great height. It is described as having a straight stem, of more than forty feet to the first branch. When not tapped too soon, the base of the trunk is often of immense girth, having a circumference of thirteen feet and upwards. About the end of the dry season, that is, in March and April, several deep incisions are made with an axe into the heart of the wood, and a good sized piece scooped out; into these holes fire is placed, and kept burning until the oil begins to run, when it is received into a bamboo, and allowed to ooze slowly drop by drop. The average produce is about 40 gallons in each season. The oil which flows from the wound is a mixture of balsam and volatile oil, and when applied as a varnish to wood or other substance, the oil evaporating deposits a hard and durable coat of resin.

These wood oils are chiefly used as natural varnishes, either alone or in combination with colored pigments; also as a substitute for tar in paying the seams of shipping, and for preserving timber from the attacks of white ants. They are said also to be useful as an ingredient in lithographic inks. This oil has all the medical properties of some of the more esteemed balsams.

From the comparatively imperfect knowledge we possess of the trees from which these valuable substances are derived, the oils generally receive the names of the localities from which they are imported—hence there are wood oils from Canara, and the Madras Presidency, Malacca, Pegu, Moulmein, and Rangoon, Singapore, Tinnevelly and China. The last named deserves notice, as being one of the substances of which the well known and much prized Chinese lacquer is made. It is used in Singapore for painting the beams and wood-work of native houses, and may also be mixed with paint when not exposed to the sun.

Dammer is the eastern name for a kind of indurated pitch or turpentine exuding spontaneously from various trees indigenous to most of the Indian islands. The principal species are *Dammara Australis* (Don), the Kauri tree of New Zealand, and *D. Orientalis*, the pitch tree of Amboyna. The trees yield the dammer in amazing quantity, and generally without the necessity of making incisions. It exudes through the bark, and is either found adhering to the trunk or branches in large lumps, or in masses on the ground under the trees. As these often grow near the sea-side, or on the banks of rivers, the dammer is frequently floated away, and collected in distant places as drift. It is exported in large quantities to Bengal and China, and is used for all the purposes to which we apply pitch, but principally in paying the bottoms of ships. About 200,000 bundles of dammer are annually exported from Siam. Dammer fetches from 26*s.* to 32*s.* per cwt. in the London market. 100 to 300 cwt. of dammer and resin are annually exported from Ceylon.

The fruit of *Diospyros Embryopteris*, a native of the East, is so glutinous as to be used in Bengal for paying boats. A cheap and ready substitute for tar for preserving cordage, &c., might easily be found in some of the numerous resins and gum elastics of India.

Copal is a valuable and singular kind of resin, that, according to some authorities, naturally exudes from different large trees found in the East Indies. Dr. Ruschenburger (*Voyage Round the World*) still asserts that it is a gum found about the roots, whence it is dug up in large quantities, and is often obtained from places where the tree had been grown many years before. The best copal is of a bright yellow color, as transparent as amber, in small rounded lumps or flat pieces, hard and brittle, but easily reduced to powder. Its specific gravity is about 1·100. When dissolved in linseed oil, it forms a beautiful varnish, which, when applied to pictures, snuff-boxes, tea-trays, &c., gives lustre to the painting and brings out the colors. Copal is liable to be confounded with gum anime, which exudes from the roots of the locust-tree (*Hymenæa Courbaril*).

According to M. Landerer, of Athens, there are three varieties of copal, differing from each other in their properties, viz., Brazilian, West Indian, and East Indian or Levantine, copal. The latter variety is sold in the bazaars of Jerusalem, Mecca, and other places as a species of choice incense, and it plays a very leading part in all the fumigating drugs of the East. The people employed in the collection of the copal in Palestine and Abyssinia dig deep trenches round the tree, and then collect and sort the pieces of gum which fall into them. They are afterwards freed as much as possible of the earth that adheres to them by washing and stirring. African copal is obtained from a species of *Hymenæa*, and from fourteen to seventeen tons are imported to Liverpool from Sierra Leone. New Zealand copal is the Kauri gum; Brazilian copal is the produce of *Trachylobium Martianum*. The imports of gum copal, which in 1846, were 759 tons, dropped in 1849, to 200 tons. From the Phillippines we imported 354 cwt. of copal in 1851; 338 cwt. in 1852; and 497 cwt. in 1853; and from Singapore the exports have lately been increasing. In 1849 we received from that entrepot 53 cwt.; in 1850, 40 cwt.; in 1852, 218 cwt.; and in 1853, 521 cwt. The trade reports also record the import of 832 cwt. of copal from New Zealand in

1852, and from those islands 3217 cwt. of gum, not enumerated, were received here in 1853. In commerce, copal is distinguished into the hard and soft kinds. The chief varieties of the former are—First, copal from Madagascar (in large flat yellow pieces), which, when cold, is tasteless and odorless, but when heated, diffuses an aromatic odor: this kind is rather rare. Secondly, the East India copal, the most common commercial variety; it is rough on the surface, bearing the impression of sand. The best specimens are colorless, and in small pieces, constituting the copal from Calcutta. A third, but very small variety, is brought from the Brazils and south of Africa. We receive all the copal proper of commerce from India, whatever its primary source may be. In the Calcutta variety pieces of all the others are to be found; nor is a distinction readily to be made between the white copal of Calcutta, and the yellow resin of Bombay; the difference appears to depend only on the care bestowed on the selection and purification of the pieces. The various resins, from anime to soft copal, Indian and Madagascar, seem to form a continued series, differing only in the increased quantity of oxygen they contain. A curious variety of copal is that in the pebble form, rounded by the action of the water, of which there are specimens on the table.

Copal is the Mexican generic name for all resins. In the collection of products from Mexico shown at Paris, there were several resinous gums, of which no particulars, however, were obtainable—one, an unnamed resin, very much like anime; another termed Axin resin, which burns with little flame and blackens, having evidently much gum with it—a whiter kind, called Archipan resin, has much the same properties, and a bitter flavor. A nominal copal from the same quarter, resembles very closely the resin of Tacamahaca, being of a white color, with a coniferous smell.

Gum Anime of commerce is a resin of great value to the varnish maker, but is now largely replaced by copal. Much of the anime received is believed to be the produce of the locust tree, *Hymenæa Courbaril*, and is, therefore, Western Anime, the Courbaril resin of Demerara. It is obtained there by digging in the vicinity of the roots of the tree, from which it exudes in a vertical direction in columns or pieces, upwards of a foot in length. It may also be obtained by tapping the tree, when in the course of a few days a large solid mass is formed. It may be obtained in great abundance in various parts of British Guiana.

The best anime is, however, obtained from Zanzibar, and some other parts of Africa, whence it is imported in mats, and the fine and medium in cases. The imports are not large of gum anime. In some years it has reached thirty tons, in others it has not exceeded five or six. We now receive about 280 tons.

(*To be Continued.*)

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*On Basaltic Glass.** By C. Stickel.

The author recommends the employment of basalt in the manufacture of glass. The applicability of basalt to this purpose has long been known in the glass-houses, but the author gives some determinate proportions by which glasses of certain properties may be obtained:—

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* From the Lond. Chem. Gaz., No. 325.

		drms.
1.	Powdered basalt,	10
	" white glass,	10
	Soda,	25
	Ashes,	5

A very dark, brittle, ugly glass.

		drms.	grs.
2.	Basalt,	10	0
	Minium,	5	0
	Potashes,	4	0
	White Arsenic,	0	5

Useless.

		drms.	grs.
3.	Basalt,	10	0
	Quicklime,	1	12
	Potashes,	2	48
	Boracic acid,	0	10

A nearly black, ugly, and very heavy glass, adapted for the decoration of monuments, stoves, &c.

		drms.	grs.
4.	Glass No. 1,	5	0
	Peroxide of manganese,	0	12

After strong fusion it forms fine, dark brownish-red, hard, glassy fragments, like Delft or Wedgewood's ware. It is adapted for plates, syrup-vessels, &c.

		drms.	grs.
5.	Basalt,	5	0
	Broken glass,	10	0
	Soda,	10	0
	Ashes,	5	0
	Peroxide of manganese,	0	5

A beautiful light bottle-green glass, which is readily drawn into threads when fused. This was the most successful of all the experiments.—*Archiv der Pharm.*, lxxxv. p. 19.

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*On the Existence of Multiple Proportion in the quantities of heat, or equivalent alteration of internal space of bodies, caused by definite changes of state as produced by Chemical Combination or otherwise.** By Thomas Woods, M. D.

Gay Lussac having shown that the combining proportions of gases and vapors are either equal in volume or some multiple of each other, and other chemists, particularly Playfair and Joule, having extended the same law to solids and liquids, it is evident that *specific volume* of its combining equivalent is characteristic of matter. But as every substance is composed of matter and space, or of particles with some distance between them, as is shown by expansion and contraction, whenever volume is altered there must be either an addition to or subtraction from the internal space of the body. This alteration of volume is evident in the case of bodies

* From the Lond. Chem. Gaz., No. 322.

expanding or contracting by gain or loss of heat; but in chemical combination, where alteration of internal space must take place also (as shown by change of temperature, and because *specific* volume being characteristic of matter, this volume must change when the matter changes, by a substitution of a mixture of two kinds of matter for one), in chemical combination, I say, this alteration of internal space is not so plainly demonstrable. Still, in the change of temperature, we have not only an evidence, but a measure of the change of state of combining bodies. For, the phenomena of heat being produced by a *dual* force acting equally in opposite directions, one body cooling or contracting as another becomes heated or expands, it may be taken for granted that whenever heat or expansion is found in one body, the opposite change is occurring in some other. Now, regarding this proposition as true, it is intended to be proved from the combinations of oxygen that the internal space of a substance is lost and gained in multiple proportion, in the definite changes of state of bodies, such as in the condensation of vapors into liquids, and liquids into solids, and the reverse; and also in chemical combinations and decompositions; and therefore that the *space* as well as the *matter* of which volume is composed can be only added to, or taken away, in what is called its combining equivalent.

In order to find whether the heat of chemical combination, which is taken as equivalent to the alteration of internal space, is equally produced by the same substance uniting with others, or if not, if it is given out in multiple proportion, oxygen is made to combine with several other simple bodies, and the alteration of temperature noted.

The method of oxidizing these substances, the details of each process being given in the paper, consisting in dissolving them in some suitable menstruum,—for instance, in sulphuric acid, liquor of potash, and nitric acid. When the two former are used, water is decomposed to oxidize the dissolved body; in the last case, the nitric acid is resolved into oxygen and binoxide of nitrogen, the former of which unites with the substance to be oxidized, the latter escaping. Other combinations and decompositions at the same time take place (as detailed in the paper), and being taken into account (decompositions absorbing as much heat as is produced by the combination of the constituents), the alteration of temperature by the oxidation alone is arrived at.

In this manner eighteen different metals were oxidized, but the heat of oxidation was obtained satisfactorily only with twelve. Other experimenters (Favre, and Silbermann, and Andrews,) have, with a different object in view, found the heat of oxidation of fourteen other substances; their conclusions are added as being from unprejudiced sources, and the result of all the experiments is brought together in a table, in order to see whether the law of multiple proportion exists. The numbers found by the different experimenters are all calculated to the same standard. The unit of heat is the amount necessary to raise the temperature of 1000 grains of water 1° Fahr., and the quantity of the metal oxidized is an equivalent of each, oxygen = 1.

To find whether the law extends to change of state when no chemical combination takes place, the amount of heat given out by the condensation of an equivalent of steam, and by the solidification of an equivalent of water, is given. The following is the table giving the thermal equivalents of the several substances, the names of the experimenters, and the ratio of proportion. It is to be remarked, that the condensation of steam being in multiple proportion with the other thermal equivalents, the expansion of all other bodies into vapor must be included; for I showed in the *Philosophical Magazine* for January, 1852, (page 48,) that all bodies expand into vapor in some multiple of their atomic volumes, and their atomic volumes being in ratio also, their expansion or gain of internal space in this definite change must be in multiple proportion.

TABLE *showing the quantity of heat produced in* 1000 *grs. of water by the oxidation of an equivalent of each substance,* O = 1.

Name of substance oxidized.	Units of heat.	Ratio.	Name of Experimenter.
Latent heat of ice,	·1603	·1603	
" " steam,	1·287	8 times ·1603	
Iodine,	·8	5 " "	Woods.
Chlorine,	−1·6	twice ·8	Favre and Silbermann.
Nitrogen,	1·6		Woods.
Silver,	1·6		"
Selenium,	2·7	3 times ·8	Favre and Silbermann.
Mercury,	2·4		Woods.
Palladium,	2·42		"
Molybdenum,	3·38	4 " ·8	"
Carbon,	3·3		Favre and Silbermann.
Arsenic,	4·8	6 " ·8	" "
Antimony,	4·8		Woods.
Copper,	4·9		Favre and Silbermann.
Cobalt,	4·8		Woods.
Bismuth,	4·82		"
Nickel,	6·5	8 " ·8	"
Lead,	6·2		Favre and Silbermann.
Hydrogen,	7·8	10 " ·8	" "
Tin,	8·0		Mean of Andrews and Favre and Silbermann.
Phosphorus,	8·1		Favre and Silbermann.
Cadmium,	8·18		Woods.
Iron,	7·95		Mean of Andrews and Favre and Silbermann.
Zinc,	9·6	12 " ·8	Favre and Silbermann.
Manganese,	10·4	13 " ·8	Woods.
Barium,	12·8	16 " ·8	"
Aluminium,	16·16	20 " ·8	"
Sodium,	17·5	22 " ·8	Favre and Silbermann.
Potassium,	17·3		" "

Note.—I proved in a paper published in the *Philosophical Magazine* for October, 1851, that "the decomposition of a compound body absorbs as much heat as the combination of the elements originally produced." I believe I was the first to prove this as a general proposition, and, by so doing, laid the foundation of almost all the thermo-chemical researches since carried on; for, as far as I am aware, no process which took decomposition into account was used before my paper was published.

In a paper read to the British Association at Belfast, and published in the *Philosophical Magazine* for November, 1852, I proved that the intensity of chemical affinity might be measured by the quantity of heat produced by the combination.

As regards the first of these papers, Mr. Joule published in the *Philosophical Magazine* for June, 1852, a memoir proving exactly the same proposition, but giving me the merit of priority in a preliminary remark. It is, however, singular that Favre and Silbermann bring forward in 1853 (*Annales de Chimie et Physique*, vol. xxxvii., p. 507), the very same experiments to prove the same fact, and give it as their own.

As regards the second paper. In six months after its publication, Messrs. Favre and Silbermann (*Annales de Chimie et Physique*, vol. xxxvii. p. 484,) prove the same truth with the same experiments, using exactly the same metals, and give their memoir as producing an original idea.

I notice these coincidences here as being remarkable, and because the propositions contained in the paper referred to are the ground-work of the present experiments, and also with a view to prevent an unconscious repetition on the part of Messrs. Favre and Silbermann.

For the Journal of the Franklin Institute.

Table of Specific Gravity of Sea Water. By W. H. Pile, M. D., Manufacturer of Hydrometers, and Specific Gravity Apparatus.

Messrs. Editors:—If you think the following observations worthy of insertion, they are at your disposal. Having been requested to graduate a number of salinometers, or hydrometers, such as are used on sea steamers to test the density of the salt water of the boilers, I endeavored to find some table giving the specific gravity of sea water containing different proportions of saline ingredients. Being unable to meet with such a table, I obtained an instrument made in New York, in order to ascertain by direct experiment the specific gravity of the various degrees marked on its scale. A very slight observation was sufficient to convince me, that *that particular scale at least* was quite unfit to give correct results; however, by comparing it with an instrument made in Glasgow, and used on board the steamer "*City of Baltimore*," (and which was marked on the scale, "No. of oz. of salt per gallon,") I find the scale is intended to indicate not the number of oz. per gallon, but the proportion of salt or saline ingredients in a quart or 32 ozs. of water. Thus, 1 oz. of salt in a quart of water is marked $\frac{1}{32}$, 2 ozs. in a quart of water $\frac{2}{32}$, &c.

It now became comparatively easy, by making solutions of dry salt in water of these various proportions, to ascertain their actual specific gravity. This I have done with care, both by delicate hydrometers showing specific gravity, and also by the specific gravity bottle.

I may here remark, that as the salinometers is intended to be used at the temperature of 200° Fah., my experiments were made accordingly at that temperature. In the table annexed, I have also given the specific gravity of the different solutions at the temperature of 60° Fah., by means of which the correctness of the salinometer may be verified with much less trouble. As the specific gravity of the various saline substances in sea water is very nearly the same as that of salt itself, the results will not differ sensibly, whether we consider the scale of the salinometer as indicating the proportion of all the salts contained in sea water, or as showing that of pure salt only, in a solution of that substance in pure water.

Table of Specific Gravity of Dry Salt (Chloride of Sodium,) in thirty-second parts, dissolved in pure water, at 60° and 200° Fahr.

Scale of Salinometer.	Specific Gravity at 60° F.	Specific Gravity at 200° F.
0	1·000	0·965
$\frac{1}{32}$	1·022	0·987
$\frac{2}{32}$	1·043	1·009
$\frac{3}{32}$	1·063	1·029
$\frac{4}{32}$	1·082	1·049
$\frac{5}{32}$	1·100	1·067
$\frac{6}{32}$	1·116	1·083

It is usual to mark the limit of density on the scale of the salinometer at $\frac{3}{32}$. Engineers, however, are not confined to this point, some blowing off sooner than others.

Corner of Passyunk Road and Catherine St., Phila.

For the Journal of the Franklin Institute.

The U. S. Steamer Niagara.

In the July number of the *Journal*, I gave my impressions of this war Steamer, and regretted that for her vast size externally, she was so deficient in accommodation and armament within. My remarks were made with the best feeling for all concerned in her construction, and while I acknowledged her beauty of outline, speed, &c., I also mentioned what I considered defects arising from a want of experience in that particular branch of ship building.

My remarks have attracted the attention of the *Editors of the Nautical Magazine*, not from any merit they possess, but from the position they occupy in this *Journal*, a courtesy for which I should thank them, and I will endeavor to make myself more fully understood. The *Niagara* is longer and wider than the other five steamers, and when complete will have about the same draft of water. She will then represent 4750 tons measurement, 12 11-inch guns, and 23 feet of draft of water. While each of the others will represent 3500 tons measurement, 40 guns from 10 down to 8-inch bore, and 23 feet draft of water. In a naval engagement, the armament of the latter ships is every way superior to that of the *Niagara*, while the former would have the advantage in attacking a fortification, as her guns are of larger bore, and have a longer range, but any one who has visited the other steamers will at once have seen that they could easily carry the *Niagara's* armament on their spar deck, without touching the gun deck battery of 8-inch guns. The Ordnance Bureau have armed these ships differently, for reasons which I have no doubt are satisfactory.

To say that it requires a ship of 4750 tons, drawing 23 feet of water, to carry 12 11-inch guns is absurd, and the *Editors of the Nautical Journal* have since the issue of their first number, written pages on this very subject, viz: the importance of having moderate sized *light draft* vessels carrying heavy guns. And I have no doubt but the Senior Editor of that *Journal* could, without difficulty, design a vessel of 2375 tons that shall carry the same armament, and not exceed 18 feet draft of water. They state that Mr. Steers was required to adapt his model to a certain amount of power; this is incorrect; his model and plans were made before the Board of Engineers met at Washington; he informed them that he could spare 100 feet in length of his vessel by the whole width, and they acting on this information, gave her 50 per cent. more power than the other ships, intending for her bunks to hold 900 tons of coal. Since the ship has been launched, this space of 100 feet has been encroached upon to make room for other stores, and my original statement that she was externally large, and internally small, is true. She might and should have had 3, instead of 2 decks. In my former article I stated that before a person could properly design a naval vessel, he must first *know* what they required. To this remark, the *Editors of the Nautical Journal* object, and they assert that private constructors ought, and do know best what models are most appropriate for naval purposes. I consider it no discredit to the private constructors of the country to say that I do not believe that there is one of them sufficiently acquainted with naval affairs to say how many square feet of deck room, how many cubic feet of capacity, or how many tons of displacement are required for a given armament (the armament regulating the crew, the crew the stores, &c.) The old maxim, that *experience teaches all things*, is as true here as elsewhere, and the *Editors of the Nautical Magazine* would themselves find if they ever make the trial, that they have something to learn even on that subject. A word in conclusion; the constructors of the Navy are gentlemen regularly brought up to their business, and as such, are entitled to the respect of those in the profession. To charge that everything done under their superintendence is badly done, that their models are bad, their workmanship defective, and by implication that they know nothing about their business, is not, in my opinion, a proper construction of the golden rule; and while it may answer for a *Naval Journal*, it will not, I trust, find many followers. FULTON.

New Volumetric Determination of Chlorine in its Combinations.[*]

By Dr. MOHR.

Levol has described a means of determining chlorine by a solution of silver, in which he renders the completion of the precipitation perceptible by an addition of phosphate of soda, the presence of an excess of silver being indicated by the yellow tint of the precipitate. The author has found that by this means the results are always too high, in consequence of the very slight color of the phosphate of silver, which requires to be present in considerable quantity to become visible in the precipitate of chloride of silver.

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[*] From the Lond. Chem. Gaz., No. 325.

The author accordingly tried arseniate of soda, and obtained much better results, from the brownish-red color of the arseniate of silver, but soon passed from this to chromate of potash, which afforded results beyond his expectations.

When phosphate, arseniate, carbonate, or chromate of silver is mixed with solution of chloride of sodium, there is an instantaneous formation of chloride of silver and of another soluble salt. At the same time the color of the insoluble silver-salt disappears; and the higher this is colored the smaller is the quantity of it that may be recognised, and the more perceptible is the transition to the colorless or light yellow condition. But if a drop of silver solution be present above the quantity of the metallic chloride, the blood-red color of chromate of silver makes its appearance distinctly. If 0·2 cub. centim. too much of the silver solution be added, the mixture is more than distinctly red. If chromate of potash were colorless, the phenomenon would be still more striking. But even in this case the formation of chromate of silver is perceived with a single drop of normal silver solution. The solution must not be acid, as then chromate of silver is not formed, or only in very small quantities, and besides bi-chromate of potash has a rather red color. A slight excess of pure carbonate of potash, on the contrary, is not injurious, because then only the pale yellow color of chromate of potash can be exhibited. Much carbonate of silver is disadvantageous, as carbonate of silver has no striking color, although it is decomposed by metallic chlorides.

Two burettes filled with normal solutions are placed close together; an undetermined quantity of fluid is allowed to run from the burette with chloride of sodium, and the red color is then produced by the addition of silver solution. The two burettes are then read off. A few cubic centimetres of a solution of neutral chromate of potash were added. The following numbers were obtained:—

Solution of chloride of sodium.	Solution of silver.
4·2 cub. centims.	4·3 cub. centims.
6·7 “	6·8 “
11·0 “	11·1 “
12·0 “	12·1 “
17·65 “	17·75 “
18·2 “	18·3 “
25·85 “	25·95 “
26·0 “	26·1 “

Thus in every case an additional $\frac{1}{10}$ cub. centim. of silver solution was employed, and this was exactly the quantity above that necessary for precipitation, but required to indicate its completion. When solution of chloride of sodium is dropped in until the disappearance of the reddish color, both burettes stand exactly even.

The author then employed this method with weighed portions of metallic chlorides, and obtained the following numbers:—

0·2 grm. of chemically pure and perfectly dry chloride of sodium = 34·4 cub. centims. of silver solution; on the other hand, 0·1 cub. centim. of chloride of sodium = 34·3 cub. centims. of silver solution = 0·20051 grm. of chloride of sodium.

0·2 grm. chloride of potassium = 1. 26·8 cub. centims. silver solution
2. 26·8 " "
= 0·19985 grm. of chloride of potassium.

0·2 grm. of chloride of ammonium = 1. 37·35 c. c. silver solution.
2. 37·25 " "

This gives,—1. 0·19967 grm. chloride of ammonium.
2. 0·199138 " "

These experiments prove that alkaline chlorides may be determined with great accuracy by this method. The author has also employed it with urine, well-water, mineral waters, saltpetre, pot-ashes, soda, and chlorate of potash, and always obtained concordant results. The amount of chlorine in a mineral spring may be determined at the well itself.

The chlorides of barium, calcium, mercury, &c., are precipitated with carbonate of soda; and if the precipitate be colorless, immediately tested with the silver solution, without filtration.—*Liebig's Annalen*, xcvii. p. 335.

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*The Manufacture of Alloys or Combinations of Metals.**

It is curious, but nevertheless an undeniable fact, that no kind of manufacture has received less benefit from the recent progress of chemical knowledge in this country, than the fabrication of alloys. This is all the more surprising when we consider the enormous field open to inquiry, and the richness of the harvest to be there gathered. A new alloy is really a new metal given to society; and although the apathy of scientific men with respect to the subject has hitherto led to the production of very few such metals, yet more than one example may be cited where a large fortune has followed upon an invention of this kind. So completely, however, has Science closed her eyes to this uncontested arena of profitable improvement, that the very word "alloy," has received no chemical definition in the latest scientific works; and hence we are compelled to begin our present observations by defining its meaning with regard to the past, the present, and its probable future.

The origin of the word, as applied to metallic compounds, is no doubt coeval with the age of the so-called "noble" and "base" metals; a form of language naturally leading to the conclusion, that when any noble metal was mixed with a base one, its nobility was "allayed" or "alloyed" and consequently diminished. In this sense, the base metal came to be regarded as the allay or alloy, and as such is thus described by an old writer:—"Alloy is the proportion of a baser metal mixed with a finer or purer; as the quantity of copper that is mingled with gold, to make it of a due hardness, is called the alloy;" and with this meaning, the word is still used by our assayers of gold and silver. But it is clear, from the very nature of the example here chosen, that no admixture of one base metal with another like itself, could generate an alloy in the opinion of writers of the old school; nor can we anywhere find that brass, bell-metal, &c., were called alloys, until mixed with gold or silver.

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* From Newton's Lond. Journ., March, 1856.

If, however, we now proceed to examine the meaning of the expression alloy, in the present day, we shall find that it extends to every admixture of two or more metals, and is, perhaps, no less absurdly diffuse than it was previously limited. On the new system, 99 parts of gold and 1 of copper is an alloy of gold; whilst 99 of copper and 1 of gold is an alloy of copper: nor is there any fixed or recognised limit, at which an admixture of metals ceases to bear the name of alloy; in fact, almost every metal we now use, might, from its casual impurities, come within the boundaries of this definition. Lead with a trace of silver will thus be an alloy of lead; and iron containing a trace of manganese an alloy of iron. Such a state of things cannot fail in the end to produce uncertainty and confusion; therefore we propose to establish, for present purposes at least, a distinction betwixt what we shall call an alloy of metals and an admixture.

Many years ago Dr. Dalton drew attention to the fact, that many of the alloys in ordinary use, as brass, &c., were very nearly atomic compounds, or in other words, mixtures of metals in such proportions, that one combining equivalent of the one was united with one, two, or three equivalents of the other; and this peculiarity was found to extend to what may be termed native or natural alloys. Thus brass of good quality consists of about 34 zinc and 66 copper in 100 parts, which is very nearly in the proportion of one atom of zinc to two atoms of copper: and again, the native alloy of gold and silver, called "electrum," is said, by Boussingault, to consist of two atoms of gold and one of silver. In fact, many such examples might be pointed out in support of Dalton's opinion, though it is quite certain that in this, as in many other of his assertions, he carried his views too far, and was misled by his mathematical bias. Silver and iron, for example, refuse to unite permanently, and separate on cooling; but the iron retains, in this case, a small and variable quantity of silver, whilst the silver retains a little iron: similarly lead and zinc comport themselves; and in neither instance can any reasonable grounds be found for inferring that an atomic combination has ensued. It would appear, therefore, that the union of some metals in atomic proportion can be effected, whilst with others it cannot; and hence, for the former, we propose to retain the word "alloy,"—using the expression "combination of metals" for the latter. On this basis, therefore, an alloy will mean a mixture of one or more atoms or equivalents of one metal, with one or more atoms or equivalents of another, so as to form what may be called a chemical compound; whereas a "combination of metals" will merely imply a mixture in no definite proportions, but suggesting the idea of a mechanical compound; thus brass formed from 34 parts of zinc and 64 parts of copper, or 34 zinc and 96 copper, would be an alloy,—whilst our ordinary silver and gold coinage would be an admixture of metals.

With this preliminary definition we will now proceed to examine the few alloys in common use in the arts, or, more correctly speaking, those compounds which nearly approach the nature of alloys. In such a list we may place brass, type-metal, bell-metal, speculum-metal, pewter, Britannia-metal, and solder. The first has been already described; the second generally consists of about 5 parts of lead and 1 of antimony, which closely approaches to 3 atoms of lead and 1 of antimony. Bell-metal is composed of 4 parts of copper to 1 of tin, and may be regarded as an alloy of 7 atoms of copper to 1 of tin. Speculum-metal contains about equal quantities of copper and tin, with small and variable proportions of arsenic: it may, consequently, be looked upon as composed of 2 atoms of copper and 1 of tin. Pewter and Britannia-metal are triple compounds of tin, antimony, and lead, in which the proportions approach, for the first, an atom of each ingredient, and for the second, 3 atoms of tin, 2 of antimony, and 1 of lead. Solder is more variable than any of the others; but the best kind is made with 3 parts of lead and 1 of tin, which corresponds to about 2 atoms of lead and 1 of tin. There are other compounds which might, perhaps, have been brought within this group; but as, in reality, none even of those we have selected, are, strictly speaking, alloys in our limited sense of the expression, it is useless to follow the subject further, than to show, by this near approach to atomic combination, how probable it is that the same substances fabricated with a due regard to that proportion, would possess more useful qualities, and less frequently disappoint the expectations of the artizan. Take, for example, the case of bell-metal, an article notorious for the uncertainty of its results: this compound contains, according to the caprice of its fabricator, from 12 to 22 parts of tin, with from 88 to 78 parts of copper, and a little antimony, arsenic, or even iron; if, however, it requires to be an alloy of 7 atoms of copper and 1 of tin, the proper proportions would be 79 copper and 21 tin. With facts of this kind before our eyes, it certainly does seem strange that nothing practical has arisen in this country with respect to alloys; and we cannot help thinking that amongst the other elements of a working man's education, the doctrine of definite combining proportions might very properly be included. It is, in effect, the "golden rule" of practical philosophy, and once learned, can never be forgotten; by its unerring agency the discoverer is led on in a safe and economical path, far removed from the vicissitudes of chance and the errors of experiment. Let us imagine, for instance, that an artizan, after much labor, has ascertained that a certain mixture of two metals will answer the purpose he requires; this man must rest content; or, if he thinks of improvement, it can only be in the hope that accident will one day furnish him with a hint; but, guided by a knowledge that substances have a tendency to form stable and uniform compounds only when they unite in atomic proportions, he would immediately examine the quantities he had found effective; and, if these approached within certain limits, he might easily make a correction, with the full assurance of a successful issue. And wherein resides the difficulty of teaching such men the simple doctrine in question? There is, in fact, but one difficulty, and that is to provide teachers. In all our systems of education the importance of imparting practical knowledge is much overlooked; and this is especially the case with the lower orders. As, however, it must be at all times more commendable to convert a workman into a philosopher than a philosopher into a workman, we trust the day is not far off in which the head and the hand of the same individual shall be able to work in unison.

Quitting the subject of alloys, the more extended question of metallic combinations presents itself; and inasmuch as that nearly the whole of the metallic articles now manufactured belong to this class, the investigation seems almost endless. When, however, we take a glance at the objects sought to be attained by these combinations, the result becomes much less formidable. With scarcely an exception, this result resolves itself into the two desiderata of increased mechanical strength and diminished destructibility from atmospheric and chemical agency. The latter is within the sphere of hourly observation, and includes the tinning of iron, brass, and copper, the zincing of iron, and the gilding and plating of many other metals, either by electricity or otherwise. The prospect of improvement in this department seems chiefly limited now to the employment of electricity through the intervention of other agents than water,—a medium evidently unfitted for the deposition of a great variety of metals, amongst which platinum, iron, nickel, zinc, chromium, and perhaps aluminium, may be mentioned. The object here will therefore consist in procuring materials of easy fusibility, capable of transmitting the electric current, and holding in solution the oxides or salts of the metals to be operated upon. For this purpose the fact discovered by Berthier may prove useful. It is that "various salts, in atomic proportion, fuse together at a much lower temperature than the more fusible of the two." Thus, an atomic mixture of carbonate of potash and carbonate of soda, fuses readily at a dull red heat. An atom of sulphate of lime, with an atom of fluoride of calcium, is still more remarkable; and innumerable instances of the same kind might be cited. Having thus obtained a suitable solvent, we may dissolve in this, at a red heat, some of the metallic substance which it is desired to coat with; and then, with perhaps a more powerful battery than for water, we may proceed in the usual way. For the sake of illustration, let us suppose that a mixture of nitrate of lead and nitrate of potash, or a mixture of oxide of platinum and caustic potash, has been fused together: the question is, whether, by making the ordinary electrical arrangements, a piece of copper might not be covered with lead or platinum to any required extent or thickness.

But the most important application, by far, of the admixture of metals, is that which refers to increased mechanical strength. On this head there seems to be enormous scope for industrial development. During many years a gross error seems to have been gaining ground, to the effect that purity was an essential condition for strength in metals; but nothing can be further from the truth. The grand characteristic of purity is the power of crystallizing; so that the more pure the metal, the less its cohesive strength; of which an excellent example is afforded by zinc. This metal when quite pure, cannot be rolled into sheets, and requires, therefore, to be mixed with a very small quantity of lead before being sent to the rollers; the lead diminishes the tendency to crystallize, in the same way that stearic acid is prevented from assuming the crystalline form, by the presence of a minute portion of wax or arsenious acid, The necessity for mixing copper or some other metal with gold and silver is extremely well known; and yet this purity hypothesis, with regard to metals in general, has not only progressed rapidly, but taken deep root in quarters where more knowledge of the truth was to have been expected. Hence we have seen pure iron, pure copper, and pure lead employed, where this very purity has been the chief cause of failure. Not to mention the monster gun of Mr. Nasmyth, with its pure iron, we will relate an instance which had many illustrations to prove it:—On one of our largest railways, a contract had been made with a large manufacturer to supply the purest copper for making the fire-boxes of locomotives. The copper was sent, and the fire-boxes made; but when used were found to wear away with the most astonishing rapidity; so that impurity in the metal was at once suspected. A searching chemical analysis proved, however, that the manufacturer had only too closely complied with the terms of his contract;—the copper was absolutely pure. Again, if we regard the present state of copper sheeting in regard to ships, we see that the pure metal has been quite expelled from use by the "yellow metal," or combination of Mr. Muntz. In short, whereever mechanical strength is of importance, a pure metal is interdicted, and this too even in the case of iron. We are not ignorant that such an assertion will excite the surprise of many, and perhaps elicit the hasty contradiction of a few; but the opinion will bear discussion, and has evidence in its favor. Thus, Berzelius tells us that "le fer contenant du cuivre à plus de ténacité que tout autre;" and a patent has actually been taken out in this country for such a mixture. Again, zinc, in minute quantity, is known to increase the strength of iron; and the same holds good with respect to gold. The best Swedish iron generally contains a little chromium or vanadium, which latter metal was, in fact, first discovered in an iron remarkable for its great strength. Not to burden ourselves, however, with examples, we will proceed at once to disclose the probable action of these mixtures upon the iron. We have seen that in the instance of stearic acid, the disposition to crystallize can be prevented by the addition of a very minute portion of some foreign substances; thus, one part of arsenious acid, will prevent the crystallization of 1000 parts of stearic acid. In the same way the tendency of iron to crystallize may be prevented by intermixture with other metals. And the great question to be solved is,—what metals answer the purpose best? He who studies the book of nature with care will seldom lay it down without profit; and thus instructed, we direct attention to one of the most remarkable combinations of iron known to mankind.

In all the quarters of the world, as if resolved to multiply the lesson, nature has placed certain metallic masses, to which the name "meteoric iron" has been given, on the supposition that these masses have fallen from the atmosphere. Many of them are known to have lain for ages where they now are, but yet they retain their original metallic character, and seem to suffer little or nothing from the oxidizing influences of air and moisture. The composition of this meteoric iron is singularly uniform, and whether near the poles or the equator, consists chiefly of iron and nickel; the latter varying from 2 to 10 per cent., with small quantities of cobalt, and (it is said) chromium. The remarkable fact that the first three metals, iron, nickel, and cobalt, are the only ones which obey the magnet, seems to establish a connexion between these masses and the name they bear, which may one day lead to interesting discoveries; but at present we wish to direct attention wholly to their apparent indestructibility, and to the great strength and ductility of the metal which composes them. To close our eyes upon a lesson of this kind is absolute folly; and as science has demonstrated to us the actual composition of meteoric iron, it follows that, if meteoric iron possesses any valuable qualities, we ought, by art, to enjoy those advantages thus providentially placed before us. In other words, the manufacture of meteoric iron ought to become a branch of the national industry. So far as science is concerned, this important question has not been lost sight of;—artificial meteoric iron has been made, and it has been tested, so as to prove that its qualities are identical with those of the native compound; that in short it is more ductile and has more tenacity than pure iron, and is not so liable to rust or oxidize.

A mixture of 98 parts of iron and 2 of nickel has all the peculiarities of the best meteoric iron; and such a mixture was recommended to the notice of the British Government during what we hope may be called *the late war.* It was proposed to that Government to make cannons, &c., from artificial meteoric iron, and some measures were actually begun for the purpose of testing the value of the proposition. It is perhaps superfluous to say, that as usual, official routine, petty jealousy, and ignorance, were stronger than either the iron or the argument, and accordingly nothing was done. Now, however, the question returns to that intelligence which gives life and character to our entire constitution: the fabrication of meteoric iron is before the manufacturing industry of Great Britain—to be accepted, or to be refused.

Hitherto the difficulty of procuring nickel, exempt from arsenic, has offered an insuperable obstacle to success; but now we know that within our own shores an abundant supply of pure nickel exists. Within these few years an ore of sulphuret of nickel, devoid of arsenic, has been found near Inverary, in Scotland, and by its means meteoric iron has been made of the very best quality. This, in fact, formed part of the argument presented to the consideration of our governmental authorities. The mine of this ore exists on the estate of His Grace the Duke of Argyll, and promises to yield an ample amount of ore when fully developed. It is now worked, and as we have before said, the produce may easily be converted into the desired compound, at a merely nominal cost. Specimens of this kind are at present before us, and extensive experiments have shown the practicability of this manufacture. So that we make no doubt of finding, in a very few years, the great lesson so long held up by nature for our guidance, brought home to the hearth of the million, in the demonstrated form of iron instruments which possess increased strength and a greatly diminished tendency to rust and tarnish. Such at least are the advantages offered by the hand of science to this interesting branch of manufactures; and it is not often that science promises in vain.

For the Journal of the Franklin Institute.

Mechanical Engineering as applied to Farm Implements.

By H. Howson, Civ. Eng.

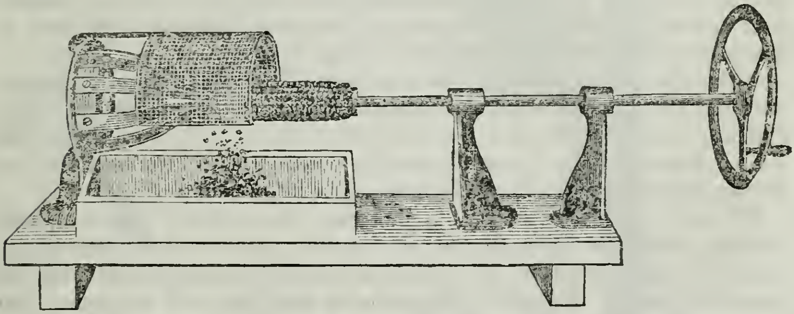
(Continued from page 49.)

Apparatus for Cutting the Kernels from Boiled and Green Corn Cobs, patented by W. B. Coates, May, 1856.

This invention consists in submitting to the action of yielding cutters, arranged in such a manner as to present a circular passage, and having sharp cutting points, cobs of green or boiled corn, by sticking their ends on prongs secured to the ends of a spindle, turning the latter rapidly and causing it to force the adhering cob into the space between the elastic cutters, that the points of the same may so operate on the roots of the kernels, as to cut them off from the husk effectually and rapidly. The apparatus is so arranged that the kernels may be cut from the thinner or thicker portion of the cob alike, and from cobs of various sizes.

Three light iron standards are secured to a plain wooden frame. One of the standards has an orifice of sufficient diameter to allow the largest corn cob to pass through freely, and round this orifice is secured a series of steel cutters, which taper so as to form a circular opening for receiving the thin end of the cob. The two remaining iron standards form the bearings for a light spindle, the outside end of which is furnished with a handled fly wheel, and the opposite end with a series of prongs, to which the thick end of the cob is caused to adhere.

The spindle with its green or boiled corn is turned rapidly by means of the handle, and at the same time pressed lightly towards the yielding cutters, by means of which the kernels are completely stripped from the husk, and drop into a movable box below. The husk passing through the above mentioned orifice is then removed from the prongs, thrown on one side, the spindle drawn back, and the operation repeated on another cob. To prevent the kernels from flying, the instrument is furnished with a shield of wire gauze or other suitable substance, so hinged to one of the standards as to be raised while the cob is being attached to the prongs of the spindles.



The yielding nature of the cutters allows the smaller as well as the larger portions of the cob, and also cobs of different sizes, to be cleared of their kernels, at the same time they serve as a guide for the cob during the operation.

This contrivance, is intended for the use of hotels, boarding houses, and large families, and is of especial utility to farmers and others, who desire to preserve green corn during the winter months, a practice now very general since air-tight preserve cans have been brought to such perfection.

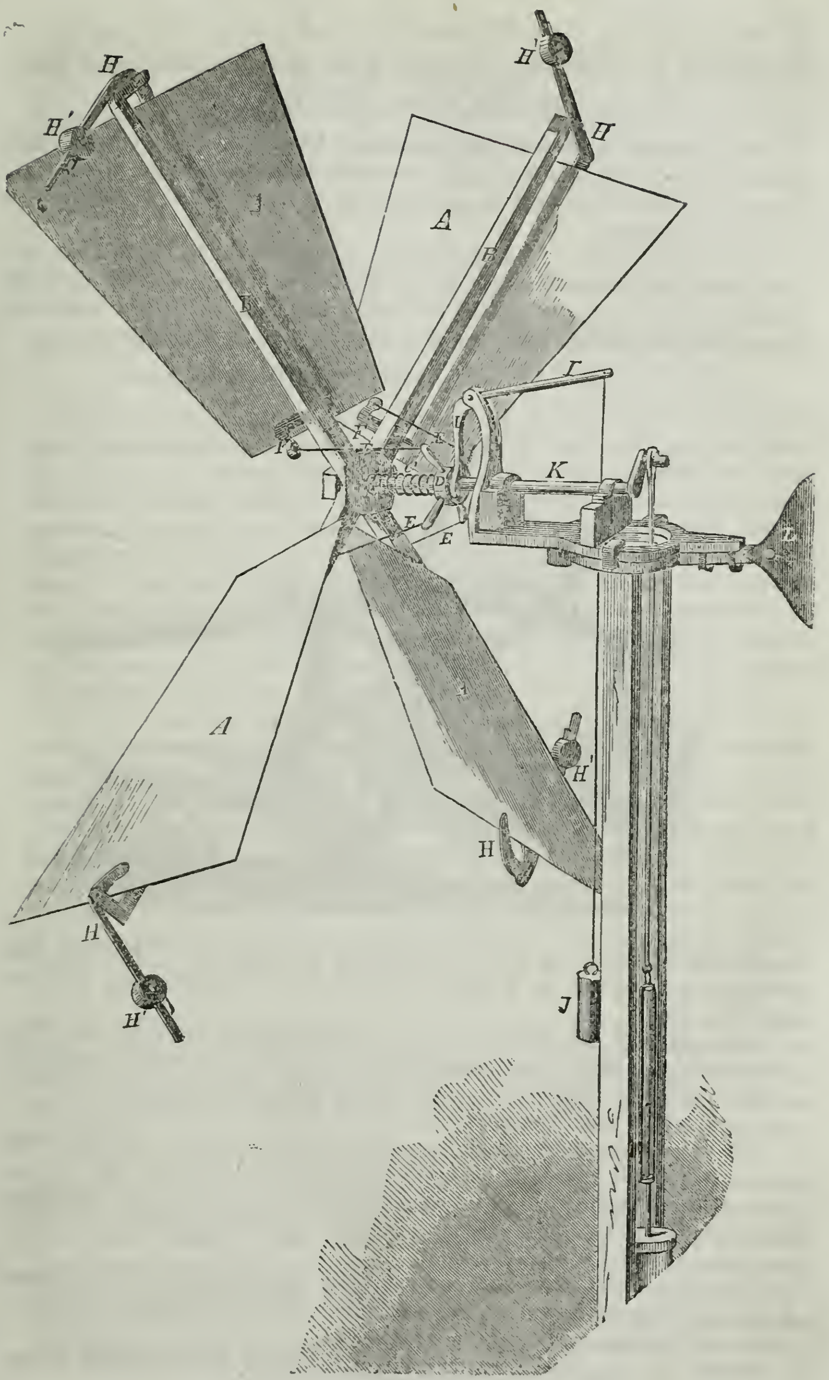
Self-Regulating Wind-mill; patented by A. Lempcke, Pleasant Mount, Wayne County. Pa., March, 1856.

The annexed is a perspective view. A are the wings hinged to the arms B, the latter being permanently secured to a hub attached to the end of the horizontal shaft K, which has its bearings in suitable pillow-blocks secured to a plate, arranged to turn on the top of the upright post of the mill. Bell crank levers H, are pivoted to projections on the ends of the arms B, in such a manner, that the cranked ends of the levers shall bear against the wings on one side of the point where they are hinged to the arms B, the straight arms of the levers being furnished with sliding weights H′, which can be readily adjusted to any point by set screws or wedges. D is a nut or collar arranged to slide on the shaft K, and from the edge of this nut project arms corresponding in number to that of the wings A. The ends of these arms are connected by means of rods E, to the ends of the levers F, which are jointed to the arms B, in such a manner that their opposite ends may bear against the wings A, in the same manner as the points of the bell crank levers H. On the shaft K, and between the hub of the arms B, and the face of the sliding nut D, intervenes a spiral spring C. Against the back of the nut bears the cranked arm of the lever I, to the straight arm of which is suspended by means of a cord or chain, the weight J, when the movement of the mill has to be stopped. To the turn plate on the top of the upright is secured the vane L, which is of similar construction, and serves a similar purpose to those used in the wind-mills heretofore described in these papers.

Although the engraving shows the end of the shaft K, as furnished with a crank for operating a pump-rod, it is easy to perceive that by a system of bevel wheels and a vertical shaft central with the upright, the motive power may be brought to such a position as to be convenient for driving threshing machines, and other farm implements.

When the speed of the mill is too great, the weighted levers H, will through centrifugal force, fly out, so that their points will turn the wings with their edges towards the wind, to an amount commensurate with the excess of speed. When it is desirable to stop the mill altogether, the weight J is suspended to a cord on the end of the lever I, so that the cranked portion of the latter forces back the nut D, and with it the spiral spring C, and through the rods E, and levers F, operates the wings so that their edges only are presented to the wind. On removing the weight, the nut D, through the action of the spiral spring recovers its former position, and at the same time the surfaces of the wings are turned to the wind.

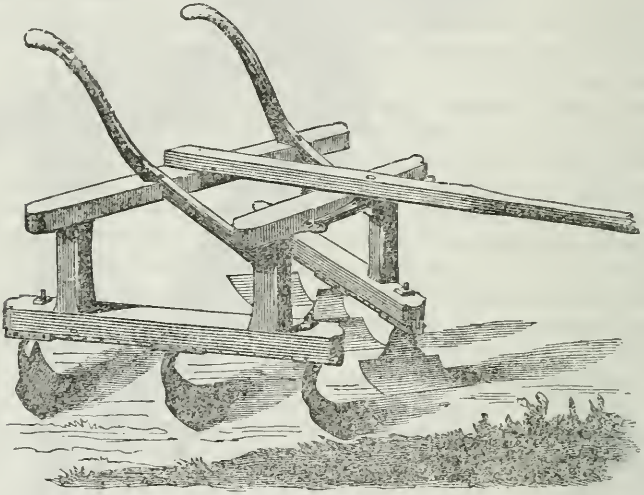
The self-regulating apparatus in connexion with Mr. Lempcke's mill is simple and ingenious, and has proved (so the writer has been informed by good authority) most efficient in practical results.


H
H'
H'
H
A
B
B
L
K
E
E
F
D
A
A
H'
H
H
H'
J

Description of a Cultivator; patented by Griffith Lichtenthaler, of Limestonville, Penna., July, 1854.

The peculiar nature of this invention consists in so attaching the shares to the beam that they may be not only readily adjusted in position, but also allowed to yield to any obstruction with which they may be brought in contact.

The apparatus has two lower beams, to which are attached uprights, the latter being connected together by cross-ties. The front end of these beams are nearer together than the back ends, thus giving the usual triangle or harrow-shape to the implement.



To the back cross-tie and front uprights, are secured the handles, and to the two cross-ties the pole by which the machine is drawn over the ground.

Under each of the lower beams is a longitudinal groove for receiving a metal strip, which is secured firmly in the groove by means of suitable wedges or keys. The upper end of each share has a socket formed by two lips, which enter the recess on each side of the metal strip.

The tops of the shares have two holes corresponding to similar holes in the strip, and through the hindermost holes of the lips, as well as through those in the strip, are inserted metal pins, but through the front holes of the lips as well as through their corresponding holes in the strip are inserted wooden pins.

The body of the shares are set nearly at right angles with the lower beams, and the soil is thrown by the shares toward the centre of the machine, as it is moved along the ground.

Should the apparatus meet with any obstruction, such as stones, roots, or stumps, the front pins being of wood will break and the shares will turn back on the hinder or metal pins as fulcrums. By this arrangement sudden wrenches or breakages of the machine are avoided. Another advantage of the arrangement is the facility of adapting shares of different forms to the machine, according to the nature of the soil on which they are required to operate.

(To be continued.)

On the Causes of the serious Loss of Silver which occasionally takes place during the Roasting of Silver Ores. By Prof. Plattner.

It has been long known from experience, that during the roasting of silver ores and furnace products in a finely divided state, in addition to the mechanical loss of silver through the formation of flue-dust, there also occurs a loss by direct volatilization, varying according to the properties of the ore from 1 to 10 per cent., and in argentiferous blende, exposed for a long time to a strong calcining heat, amounting to much more. These facts give rise to a question which may be divided into two parts, namely,—1st, How does it happen that in ores containing an equal per centage of silver, but of different qualities and composition, the loss per cent. in silver differs when they are subjected to the process of roasting? And, 2dly, In what condition is the silver volatilized?

To solve the first part of this question, many experiments were made on the small scale by the author, in the following manner :—Various substances, for the most part quite free from silver, were reduced to a fine powder, and mixed with other substances rich in silver, and also in fine powder, in such proportion that the mixture should contain from 1 to 2 per cent. of silver; these were then exposed to the action of heat and atmospheric air in capsules of clay. For this purpose a muffle was used heated to dull redness, and most of its openings closed so as to allow of a very moderate circulation of air within it. The heat was gradually raised until it reached the temperature at which sulphate of copper is slowly decomposed. The substances used to mix with those rich in silver were pyrites, blende, various anhydrous metallic sulphates and metallic oxides, and finely powdered quartz; those rich in silver were sulphuret of silver, light and dark Rothgiltigerz (pyrargyrite and proustite), metallic silver, sulphate, arseniate, and antimoniate of silver, all in fine powder.

These substances were roasted from three-quarters of an hour to an hour and a half, and then assayed for silver in the usual way; but in order to ascertain more accurately the amount of silver which should have been obtained from them, an equal amount of the unroasted ore was assayed with equal quantities of lead, so that the slight loss always occurring from the absorption of silver by the cupel ("Kapellenzug,") would be the same in each case; the loss of silver during the roasting was then found by comparing the weight of the two buttons.

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[*] From the Lond. Chem. Gaz., No. 324.

The results of these experiments showed:—

1. That the loss of silver in question was occasioned chiefly by chemical causes.

2. That a volatilization of silver appeared to take place when the silver in the ore either passed from the state of sulphuret into that of metal, or when the oxide of silver, in combination with sulphuric acid, again suffered decomposition.

The loss appeared to be greatest in light, loosely aggregated substances whose particles had little cohesion and were not disposed to sinter together, as they were more readily penetrated and traversed by the atmospheric air.

3. That the loss of silver was greater when the roasting was protracted, if at the same time the temperature was increased.

4. That the loss was increased when magnetic oxide of iron or suboxide of copper exercised a reducing action on sulphate of silver.

5. That generally the loss of silver was greater when the silver existing as sulphate was exposed to a protracted roasting at a high temperature in company with free metallic oxides, than when it was present as arseniate or antimoniate of silver. The reason of this is, that the sulphate of silver is decomposed and reduced to metallic silver before either of the other salts, and more particularly before the arseniate, although their behavior at a high temperature is not altogether the same, as the antimoniate of silver is very rapidly decomposed, the other two salts more slowly.

With regard to the second part of this question, in what condition is the silver volatilized? The following experiments on the small scale were instituted by the author:—

1. 3 grms. of silver, in a minute state of division, were carefully mixed in a glass mortar with an equal volume of finely powdered quartz; this mixture was introduced into a glass tube ½ an inch wide, and about 20 inches long, of difficultly fusible glass. And after that part of the tube which contained the mixture had been enveloped with platinum foil in order to ensure a more uniform application of the heat, it was raised by means of a spirit-lamp to a moderate red heat (incipient *strong calcining* heat), while from a gasometer a current of dry hydrogen gas was passed slowly over it. Although this experiment was prolonged for upwards of an hour, not the slightest appearance of volatilization of the silver could be perceived. 2. An experiment conducted in the same manner with carbonic oxide, led to the same result. But 3, when a similar mixture was treated with oxygen gas, there quickly appeared in the neighborhood of the mixture, towards the open end of the tube, a slight, dull, grayish-white coating, which gradually increased, and extended about an inch along the tube; afterwards that portion of the coating nearest to the mixture was converted into a shining, annular, metallic crust. At the conclusion of the experiment, which like the former ones was carried on for an hour, a portion of the sublimate was removed, and on rubbing it in an agate mortar was found to be metallic silver, and this was confirmed by testing in the wet way. The part of the glass tube where the mixture had rested was found to be stained of a light to a dark yellow by oxide of silver, both above and below, and a

little to the right and left of it. 4. A mixture of finely divided silver and ignited oxide of zinc, treated in the same manner with oxygen gas, gave in general the same results; the metallic coating, however, was not quite so striking; the tube also was found to be colored yellow by oxide of silver where the mixture had rested.

From the results of the above experiments we may draw the conclusion, that that portion of the silver which in addition to that carried off as flue-dust escapes during an oxidizing roasting, is removed, not in the metallic state, but at a certain temperature commencing at a low red heat, as oxide of silver, which afterwards, in its free state and at a low temperature, is again reduced to metallic silver; but as it then exists in such an extremely minute state of division, it becomes mixed with the gaseous products of the combustion of the fuel, and also the gases and vapors resulting from the oxidation of the ores, and is readily carried away with them into the atmosphere.—*Berg-und hüttenmann Zeitung*, 1855, No. 35.

On Antimonial Vermilion.[*] By E. Mathieu-Plessy.

The author has invented a process which furnishes antimonial vermilion of a beautiful color, and which is sufficiently simple to be employed in its preparation on the large scale.

Hyposulphite of soda is best prepared by the action of sulphur upon sulphite of soda; it is not usually allowed to crystallize. The sulphite of soda must be in the neutral state to avoid the action of the sulphurous acid upon the hyposulphite. The sulphite of soda is most simply and cheaply prepared in the following manner, recommended by Camille Köchlin. In the upper part of a vessel, the bottom of which is broken out, a sieve containing large crystals of carbonate of soda is fixed. Into the lower part of the vessel projects a furnace pipe bent at right angles, which is attached to a small clay furnace. Into this furnace sulphur is thrown by little and little, and burns into sulphurous acid, which passes through the tube into the vessel, and there acts upon the carbonate of soda. The combustion of the sulphur may be regulated as occasion requires through the door of the furnace; the draft is quite sufficient, and in the course of three or four days the crystals of carbonate of soda are acted upon to a considerable depth. The very friable sulphite of soda may be readily separated from the unaltered nucleus if any remains, and the latter may then be put back into the sieve. The sulphite of soda is dissolved in water so as to produce a solution of 25° B., and this is saturated whilst hot with crystallized carbonate of soda. When effervescence no longer occurs on the addition of this salt (which is the best criterion, as litmus paper gives no satisfactory indications), or rather when the dilute sulphite furnishes a slight effervescence of carbonic acid on the addition of muriatic acid, flowers of sulphur are added, and the mixture is heated in an earthen vessel for three hours on the water-bath, stirring and replacing the water that evaporates. When the fluid is cool, it is filtered and diluted until it shows 25° B.

Perchloride of antimony is prepared by heating powdered black sulphuret of antimony with commercial muriatic acid. When the evolution of sulphuretted hydrogen begins to diminish at a gentle heat, the mixture is boiled for a few minutes. On cooling, the clear liquid is decanted. To avoid inconvenience from the sulphuretted hydrogen gas evolved during the solution of the sulphuret of antimony, it may either be passed into a solution of soda, or allowed to pass through a tube drawn out to a point at the extremity, close to which the flame of a spirit-lamp is placed; by this the sulphuretted hydrogen is burnt, even when it is mixed with much aqueous vapor. The solution of chloride of antimony obtained is diluted with water to 25° B.

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[*] From the Lond. Chem. Gaz., No. 322.

When the solutions of hyposulphite of soda and chloride of antimony are thus prepared, the antimonial vermilion is prepared in the following manner:—4 litres of solution of chloride of antimony, and 6 litres of water are poured into a stoneware basin, and after these, 10 litres of the solution of hyposulphite of soda. The precipitate which is produced by the water is rapidly dissolved by the hyposulphite of soda in the cold. The basin is now placed in a water-bath, which is heated to boiling; in this the temperature of the mixture gradually rises. Towards 86° F. the precipitate begins to form; it is at first orange-yellow, but gradually becomes darker. The temperature is allowed to rise to 131° F., when the basin is removed from the water-bath, and the precipitate is allowed to settle, which takes place rapidly. The fluid is separated from the precipitate by decantation; the precipitate is washed first with water containing one-fifteenth of muriatic acid, and afterwards with common water, then collected on a filter and dried. In the moist state the antimonial vermilion has a shining red color, but in drying it loses a little of its lustre. It was also produced in the cold, but the process described is more certain, and furnishes a finer color.

The author has analyzed the antimonial vermilion thus prepared, and at the same time examined the amount of water in the ordinary orange-red sulphuret of antimony (precipitated by sulphuretted hydrogen). 0·668 grm. of the latter lost 0·038 grm. in weight when heated to 392° F.; 0·808 grm. of antimonial vermilion showed a loss of 0·009 grm. when heated to the same temperature. The latter might be attributed entirely to hygroscopic water, and the antimonial vermilion may therefore contain no chemically combined water. The loss of weight which the orange-red sulphuret of antimony undergoes shows, on the contrary, that this contains water chemically combined, and this loss of weight gives it the composition $SbS^3 + HO$. The further analysis of the antimonial vermilion was effected by treating a weighed quantity of it with nitromuriatic acid containing an excess of nitric acid. A portion of sulphur remained undissolved, which, after tartaric acid had been mixed with the fluid, and the latter had been diluted with water, was separated, dried, and weighed. The fluid contained the remainder of the sulphur in the form of sulphuric acid, which was determined by precipitation with chloride of barium. The antimony was merely determined from the loss. The result of the analysis was, that the antimonial vermilion consists of 1·1 per cent. of water, 26·7 per cent. of sulphur, and 72·2 per cent. of antimony. As the water is to be regarded as non-essential, it appears that the compound consists entirely of sulphur and antimony. —*Polytechn. Centralbl.*, 1855, p. 1451.

*On the Manufacture of Crown and Sheet Glass.**

Read before the Society of Arts, &c.

A table of crown glass of to-day would scarcely recognise as of kindred origin a table of the earlier part of the present century. The principle of the process in each case was the same: it is the improvement of minute details that produces so different a result. To Mr. Hartley and Mr. Chance, who, during the years 1832 to 1836, gave to the manufacture of this glass their constant attention, is owing, in a great measure, its present status.

When the tables of crown glass are drawn from the kiln, they are covered with a whitish film or "hum." The history of this hum is curious. It arose, probably, in the first instance, from the deposition of sulphur from the fuel upon the surface of the glass. It thus became associated with the process of annealing, and buyers fancied that the more hum there was upon the glass, the better was the glass annealed. The manufacturers of crown glass, ever ready to accommodate themselves to the fancies of their customers, have taken the trouble to produce an additional hum, by the introduction of sulphur in the kiln. The members, however, of the Glass Jury of the Paris Exhibition, not being in the secret of this hum, stoutly maintained that glass thus clouded must be bad glass, and that the hum was owing to the exudation of the alkali.

In the warehouse, the tables are laid upon a "nest," or cushion, and are divided, by the diamond of the splitter, into two unequal parts, the larger half containing the "bull's-eye." The diameter of the table is measured on the nest, the usual size being now about 54 inches, and weighing 13 lbs. Tables have been made as wide as 70 inches, but the difficulty of manipulation, and the uncertainty of the result, render such sizes too costly to be general.

The splitter carefully examines each table before splitting it, and turns it round till he has brought it into the position in which he may split it to the best advantage, announcing at the same time its quality. The first quality is called "best"—*rara avis in terris*, the next seconds, then thirds, fourths, cc, ccc, or Irish, and tables containing any very glaring defects come under the denomination of "coarse."

These variations in quality depend on the presence or absence, number, and extent of those defects to which, even in the best regulated manufactories, glass is unavoidably liable. Perhaps the glass has been badly melted, and is seedy,—full, that is, of little vesicles, to which the rotary motion has given a circular shape; or, the gatherer may have enclosed air within his "metal," and a gatherer's blister is the result, or a pipe blister, or pipe-scales, or dust from the pipe-nose, or dust from the marver, or dust from the bottoming-hole, or dust from the nose-hole, or dust from the flashing furnace, or bad bullions, or scratches, or music lines, may disfigure the table; or the glass may be crizzled, or curved, or bent, or hard, or smoky, or small and light,—defects to explain which, would be a long and dreary task. No wonder that tables of the best quality are few and far between, in some manufactories a forlorn hope never to be realized.

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* From the Lond. Builder, No. 687.

The difficulty of obtaining glass free from defects will account for what may at first astonish,—the fact that the value of a table of the highest quality is three times that of the lowest.

The defects enumerated, many as they are, are instantly detected, even through the obscuring hum, by the splitter, who not only can descry faults invisible to ordinary eyes, but can refer each fault to a particular stage of the process, and to a particular cause in that particular stage, and the faults are registered accordingly. The nomenclature of defects is much facilitated by the mapping out of the table into certain ideal divisions, derived from shapes assumed during various periods of the process. The centre lump is termed the bullion: round this lies the bottom; next the bulge; the shoulder, the top, and the rim, or the outermost edge of the circle.

Independently, however, of these defects, there are certain other disadvantages under which even a faultless table of crown glass must unavoidably labor. The cutting of a circle into rectangular sheets must necessarily be attended with waste, while the bull's-eye confines those sheets to comparatively small sizes. Uniformity of thickness, also, except by the most skilful manipulation, is difficult of attainment. Wavy lines, termed music lines, forming a series of concentric circles round the bull's-eye, and owing to the treatment of the glass upon the marver, were formerly a common defect; but improvements in the process have in a great measure removed them.

On the other hand, extreme brilliancy of surface is a distinguishing characteristic of this glass, ascribed by some to the influence of the marver, by others to the effect of the flashing-furnace.

It is this brilliancy of surface which has enabled crown glass to maintain in England its position against that formidable rival of which I must now briefly speak.

Imagine, as before, a lump of glass collected upon the end of the gatherer's pipe. For the metallic table or marver is now substituted a block of wood, so hollowed out as to allow the lump, when placed upon it, to be expanded by the blower to the diameter ultimately required. The block, during this operation, is sprinkled with water, to prevent the wood from being burnt, and from scratching the glass. From the block it is carried to the blowing furnace, which is accessible through a number of holes or openings, each hole being allotted to a single blower. In front of the furnace corresponding to each opening is a stage or frame of wood, erected over a large pit or well about 10 feet deep, and these parallel stages are sufficiently apart to enable each blower to swing his pipe to and fro in a vertical plane, that the glass may run freely out, as the phrase is, to the required length. When the glass has been sufficiently heated in the blowing furnace, it is brought out, and swung round in a vertical plane, and also backwards and forwards; and the blower, at the same time, by blowing down the pipe, constantly keeps the lengthening cylinder full of air.

Uniformity of substance and of diameter is chiefly secured by the skill of the workman, who, when he finds the metal running out too freely, holds the cylinder vertically above his head, still keeping it well filled with air. These operations are continued until the cylinder has reached the length required. The diameter of the cylinder was determined by the wooden block, and remains the same throughout.

The next stage of the process is opening the end of the cylinder. The thinner kinds of glass are all opened by submitting the end of the cylinder to the fire, and at the same time forcing in air through the pipe and stopping up its aperture. The air is expanded by the heat of the fire, and bursts open the cylinder at the end; this being the hottest and most yielding part. The aperture thus made is widened out to the diameter of the cylinder, by subsequently turning the cylinder to and fro with the opening downwards.

The thicker kinds are opened by attaching a lump of hot glass to the end of the cylinder, which thus becomes the hottest and weakest part, and the air forced in by the blower as before, bursts it open. The opening is then enlarged by cutting round it with scissors. If opened in the furnace, as in the first case, the ends of the thicker cylinders would be so thinned out that a considerable portion would be wasted.

The cylinder is now laid on a wooden rest, or "chevalet," and is easily detached from the pipe by the application of a piece of cold iron or steel to the neck of the glass near the pipe-nose: the neck being hot suddenly contracts externally and breaks away from the cylinder. There still remains the cap or end of the cylinder, which is easily taken off by wrapping around the end of the cylinder a thread of hot glass, removing the thread, and applying a piece of cold iron to any point which the thread covered.

On the continent, the operation of heating the glass cylinder is performed in the apertures of the melting furnace; but the obvious advantage of a separate furnace has induced, I believe, one French manufacturer to adopt the English plan, and others will probably follow his example.

The cylinder, as it now lies upon the chevalet, is little more in weight than two-thirds of the lump of glass which the gatherer collected on his pipe. The quantity left upon the pipe-nose, with that which formed the cap of the cylinder, are nearly equivalent in weight to one-half the cylinder.

The finished cylinder is now split open by a diamond, which, attached to a long handle, and guided by a wooden rule, is drawn along the inside length of the cylinder, and should pass through or in the neighborhood of some notable defect or groupe of defects, if such be present,—for defects thus brought to the edges of the subsequent plate of glass are of lessened injury to its value. An object to be avoided is the black mark which the cylinder sometimes receives from the charring of the wooden "chevalet," on which, while hot, it rested in the glass-house. If the diamond passes inside the cylinder, over the space occupied by this mark upon the outside, the cylinder will fly to pieces. The reason of this is not difficult to understand. The chevalet prevented, by its non conducting tendency, that portion of the glass in which it was in contact, from cooling equably with the rest, and the particles at that point remained in a state of tension. A careful blower will never place any large defect in his cylinder in contact with the chevalet, being aware of the probable result.

The use of the diamond in dividing plain surfaces of glass, dates from the sixteenth century; but its application to the splitting of cylinders which h adnot undergone the process of annealing, was introduced not more than twenty years ago by M. Claudet. Previously, all such cylinders were split by a red hot iron, and, even now, all cylinders of flashed glass, that is, of ordinary sheet glass covered inside with a skin of colored, are still split in the same fashion.

On the continent, I believe, the diamond is gradually replacing the use of red hot iron, though the latter is still the method more generally practised.

The cylinder is now ready for the flattener, who, having prepared it by a preliminary warming in the flue, by which it is introduced into his furnace, passes it, by means of a croppie, or iron instrument, on to the flattening stone, from the slight irregularities of whose surface it is protected by a lagre, or sheet of glass, laid upon the stone. Upon this lagre the cylinder, lying with the split uppermost, is soon opened by the flame passing over it, and falls back into a wavy sheet. The flattener now applies another instrument, a polissoir, or rod of iron, furnished at the end with a block of wood, and rubs down the waviness into a flat surface, often, upon a refractory piece, using considerable force. Some cylinders are so distorted in the blowing that no rubbing can flatten them; but all, good, bad, and indifferent, pass through the same treatment. The flattening stone is now moved on wheels to a cooler portion of the furnace, and by the aid of the flattening fork, delivers its sheet to another stone, called the cooling stone. From this, when sufficiently stiff, it is again lifted, and then piled generally on its edge, in order to be annealed.

Very different, both in process and result, was the manufacture of spread, or German cylinder glass, which preceded the introduction into England of the French system. The cylinder, unskilfully blown, was cut open while hot with a pair of shears, and spread out immediately upon a plate of iron, covered with sand. The thickness of this glass was very irregular, and its surface very coarse.

(To be continued.)

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, August 21, 1856.

John Agnew, Vice-President, in the chair.

John F. Frazer, Treasurer.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Letters were read from the Royal Geographical Society of London.

Donations to the Library were presented from the Royal Geographical Society, and the Geological Society of London; The School of Mines, Paris, France; The Austrian Engineers' Society, Vienna; Hon. Richard Brodhead, U. S. Senate; M. Lewis Clark, Esq., St. Louis, Missouri; The Mercantile Library Association, Boston, Mass.; The Regents of the University of the State of New York, Albany, N. Y.; and from Messrs. Parry & M'Millan, Lindsay & Blakiston, and Ayres Stockly, Philadelphia.

Mr. R. A. Wilder, Engineer of the Mine Hill and Schuylkill Haven Railroad, presented to the Cabinet three slabs of Sandstone, deeply indented with ripple marks, from a quarry in the second mountain at the Gap of West Branch of Schuylkill.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of July.

The Board of Managers and Standing Committees reported their minutes.

On motion, the Committee on Exhibitions were instructed to take the necessary steps to hold an Exhibition of American Manufactures next Fall, agreeably to their recommendation this evening.

Candidates for membership in the Institute (5) were proposed, and the candidates proposed at the last meeting (4) were duly elected.

Mr. Howson exhibited a model of an improved ice boat, for which a patent was granted on the 5th of August last, to Messrs. H. and W. Brown. The invention consists in constructing a steamboat with a recess at the bows; the bottom of the recess consisting of two inclined shelves, one on each side, and divided by an angular rib, tapering upwards from the bows, and terminating with a curve under the deck; the end of the recess forming an angle, the sides of which also taper towards the bows of the boat.

In connexion with the above is a guard on each side, suspended from, and secured to the deck. The whole arrangement is for the purpose of breaking the ice, and directing the broken pieces underneath the body of the ice that remains unbroken on each side of the boat, thus forming a clear channel for the passage of sailing and other vessels.

A correct description, with illustrations of the above invention, will be given in a future number of this *Journal.*

Mr. H., also, exhibited a machine for cutting the kernels of green or boiled corn from the cob, for which a patent was granted to W. B. Coates, of this City, in May last. A full description with engraving of this useful apparatus, will be found in the present number, page 197.

A safety or detective envelope, for which a patent was granted to the same inventor on August 5th, was also exhibited by Mr. Howson.

It consists of an extra lap or turn-down, which by adhesive matter is secured to the enclosed letter, so that any attempt to abstract the contents of the envelope by cutting the edges of the same, may be at once detected.

This invention will also be illustrated and described in a future number of this *Journal.*

Report on an Improvement in Feed Apparatus, Invented by Jacob Frick, of Philadelphia.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "the Improvement in Feed-Apparatus," invented by Jacob Frick, of Philadelphia—REPORT:

That it consists of a check valve, blow-off valve, and safety-feed valve, with an alarm apparatus attached, each having its own distinct chamber, and all contained in one compact instrument. The check valve is of the usual puppet kind; the blow-off valve is a three-way cock whose passages complete the communication between the boiler and check valve chamber, when the feed-water is passing into the boiler, or between the blow-off pipe and the boiler when the latter is being emptied. The safety-feed valve is the same as used heretofore, with a lever bearing upon the valve, and weighted to give a rather greater pressure per sq. inch than is had in the boiler, and which, by rising when the communication between it and the boiler is closed, permits the water to pass away through the waste pipe.

The alarm apparatus is operated by the waste water passing through a cylindrical chamber, in which slides a piston valve that is forced downwards by the pressure of the water, until several grooves cut in the wall of the chamber, parallel with its axis, are uncovered sufficiently to allow the water to pass through them and beyond the piston, and re-enter the chamber and pass away through a pipe attached to it. When the return stroke of the feed pump relieves the valve of the water pressure, it rises by the action of a spring coiled around its spindle, and thus vibrates a bell, which may be placed in any part of the engine room, or in the office, and notify the attendant or proprietor when the supply to the boiler is cut off.

The Committee commend the inventor for the ingenuity shown in the arrangement of the various parts ordinarily used for the purposes set forth, and for the excellence of the workmanship of the model, and consider that when a cock is interposed between the check valve and the boiler, it would be useful, by preventing the bursting of the feed pipes, if the communication should become closed by the shutting of the cock or obstructions in the pipe.

The single attachment (although much used on the cylinder boilers of stationary engines,) cannot be considered an advantage; for, if the supply water be impure, the blow-off pipe should be attached to that part of the boiler where its contents are most quiescent, as the foreign particles always tend to such a place, and subside; this can never be near the attachment of the supply pipe, even though at a point where by the disposition of the fire surface the ebullition is least; for the current of entering water will prevent any matter from settling near it.

By order of the Committee,

Philadelphia, August 14th, 1856. WILLIAM HAMILTON, *Actuary.*

Description. By H. Howson.

This invention consists in the combining together in one instrument of a check valve, stop valve, and blow-off valve for steam boilers, in such a manner that the whole may be secured to the boiler by one attachment only, thereby avoiding the necessity of piercing and wounding the boiler in several places for the purpose of making the separate and distinct attachments hitherto employed for the same purpose ; it further consists in employing in connexion with the above combination of valves and cocks, a safety valve, and alarm apparatus, fully described hereafter, for the purpose of notifying the attendant engineer when any undue obstruction is offered to the regular flow of water from the feed pump to the boiler.

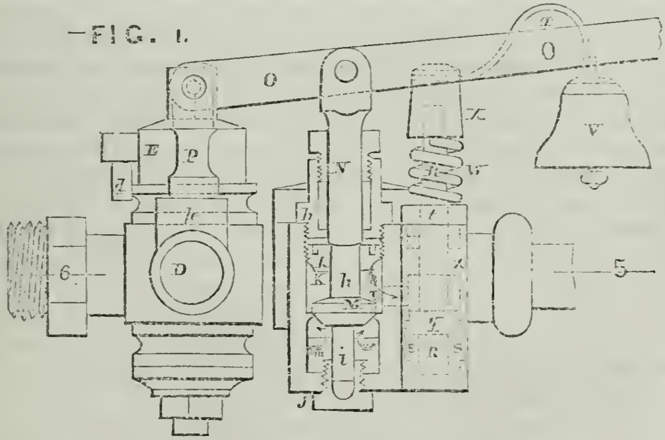
On reference to the annexed illustrations—

Fig. 1, Is an elevation (partly in section on the line 1—2, fig. 3).
Fig. 2, A sectional elevation of the same on the line 3—4, fig. 3.
Fig. 3, A sectional plan on the line 5—6, fig. 1.

The same letters of reference allude to similar parts throughout the several views.

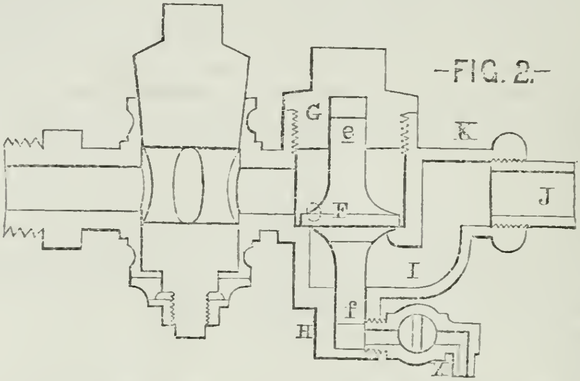
A, is the chest containing the check valve, and B, the casing of the combined stop and blow-off cock. Cast to, and projecting at right angles to each other from the casing B, are the hollow projections, C and D, the former screwing into, and communicating with the steam boiler, and the latter forming the blow-off passage. E, is the plug of the stop and blow-off cock, having one opening *a*, directly through it, and another opening *b*, communicating with *a* at right angles.

—FIG. 1.



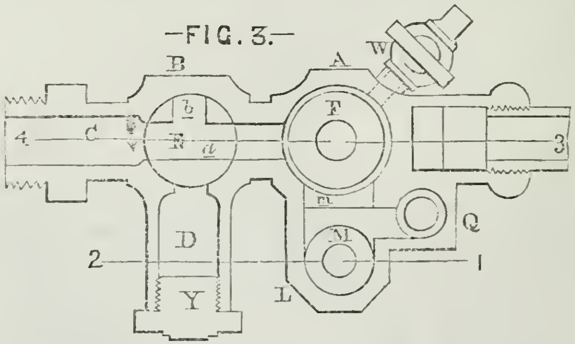
These openings are so arranged that when the plug is turned to the position shown in fig. 3, there is a direct communication from the check valve through the opening *a*, and through the interior of C to the boiler, but when turned in the direction of the arrow, so that the opening *b*, coincides with the interior of the projection C, the passage from the check valve is stopped, and a communication opened between the boiler and the blow-off passage D. The top of the plug E, is furnished with a projection *d*, which strikes against projections on the top of the casing B, and prevents the said plug from being turned to any other positions than the two above described. F, is the check valve operating and having its seat in the chest A, the upper stem *e* of the valve moving in an orifice in the cover G of the chest, and the lower stem *f*, moving in the opening of the projection H.

-FIG. 2.-



Below the valve, the interior of the chest communicates by the curved passage I, with the feed pipe J, which screws into the hollow projection K. To the chest A of the check valve, is cast the chest L, of the safety valve M, below the seat of which the two chests communicate with each other by the passage *m*. The lower stem *i*, of the safety valve M, moves in the nut *j*, which screws into the bottom of the chest L, and the upper stem *h*, in the nut *k*, below the stuffing box *t*. Through the latter passes the rod N, the end of which bears on the top of the stem *h* of the safety valve, its upper end being jointed to the lever O, which has its fulcrum on the stud P, the latter being screwed into a projection *p*, on the blow-off passage D.

-FIG. 3.-



Cast or otherwise secured to the chests A and L, is another chest Q, the lower part of which is bored out for the reception of the piston *q*, on the rod R. Above the piston *q*, the interior of the chest Q, communicates by the passage *n*, with the space between the valve M, and nut *k*, in the chest L.

The interior of the chest Q, in which the piston *q* operates, has several grooves S, the top of which are covered by the piston when the latter is at rest, but when moved downward by the action (hereafter described), a passage is formed from the space in the chest L, above the valve M, through the passage *n*, and down the groove S, through the bottom of the chest Q. The latter is furnished at the top with a stuffing box *t*, through which passes the piston rod R.

This rod is furnished at the top with a nut *w*, between which and the top of the stuffing box gland *t*, intervenes a spiral spring *w*, which has a tendency to keep the piston *q*, with its rod in the position shown in fig. 1, when not otherwise depressed.

In order to prevent the piston rising too high, the rod is furnished with projections *x*, which fit against the shoulder in the chest Q.

To the top of the nut *w*, is attached a spring T, furnished at the end with a bell, or the top of the piston rod R, may be connected by means of wires to any other suitable alarm apparatus within the hearing of the attendant engineer.

W, is a cock for discharging any water which may collect in the chest A, above the check valve F and X, a similar cock for drawing the water which may collect below the valve, in the projection H. Y is a plug which always remains screwed into the end of the projection D, as long as the latter is not used for blowing-off from the boiler.

The plug E, of the stop and blow-off cock being in the position shown in fig. 3, and the lever O, weighted to suit the pressure in the boiler, against which the water has to be forced; a communication exists from the feed pumps through the pipe J, attached to the same; through the seat of the check valve F (which operates according to the action of the pump in the usual manner), and the plug E, of the stop and blow-off cock to the boiler. Should the plug have been turned accidentally or otherwise, so as to obstruct the passage of the feed water to the boiler, the pump of the engine being still in operation; the excessive pressure occasioned by this obstruction, and the action of the pump combined, will cause the water to act on the underside of the safety valve M, and raising the latter will pass through the opening *n*, to the space in the chest Q, above the piston *q*, passing down the latter until a portion of the water can escape down the grooves S, and at the same time causing the bell to ring. During the time the feed pump takes its upward stroke, this excessive pressure will cease, and the spiral spring *w*, will raise the piston *q*, to its former position, but immediately the down stroke commences, the depression of the piston takes place, and the alarm continues until the engineer either regulates the pump or the plug E, of the stop and blow-off cock. When the latter has to be used for blowing-off the boiler, the plug Y is removed, and a bent or other pipe directed to an adjacent drain or sewer screwed into its place, the plug E, is then turned until its opening *b*, coincides with the passage through the projection C, to the boiler, when a blow-off passage is immediately formed. When used as a stop cock only, for obstructing the feed water from the boiler, the plug Y is retained in the position shown in fig. 3.

Report on Hoard's Gas Regulator.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was refered for examination a "Gas Regulator," invented by Mr. J. W. Hoard, of Providence, Rhode Island—REPORT:

That the regulator under consideration consists of a cylindrical box, divided into two cylindrical compartments by a diaphragm; in the centre of the diaphragm is a circular opening, fitted with a conoidal valve. In the centre of the cover of the upper cylinder, is fixed a tube projecting upwards, and having a screw cut on its inner surface; a nut with an outside thread is so arranged as to move up or down in the cylinder by turning it with a screw-driver reached into the tube; to the bottom side of this nut is secured one end of a spiral spring, the other end of which is attached to the valve. In the bottom of the lower cylinder, there is a narrow annulus for the reception of mercury.

Within the lower cylinder is fitted a small gas holder, the top of which is attached to the bottom of the valve, the lower edge of the holder is inserted into the mercury seal.

An opening is made through the end of the lower cylinder beneath the gas holder, so as to secure atmospheric pressure upon the inside of the holder.

The gas inlet communicates with the upper portion of the regulator (above the diaphragm), and the outlet is placed on the side of the lower cylinder. The position of parts is such that the pressure of the street main is exerted upon the upper side of the valve tending to close it, and the burner pressure influences the lower side of the valve, and the top of the small gas-holders, whilst the interior of the gas-holder is subjected to atmospheric pressure constantly. The spiral spring transfers the weight of the valve and holder to the nut in the tube, and by screwing the nut up or down in the tube, the burner pressure can be increased or diminished at pleasure.

In the experimental trials upon this regulator, the inlet was connected with the street main by a service provided with a stop-cock, with which to vary the street pressure, and a pressure gauge was placed between the stop-cock and the regulator. To the outlet was connected a branched pipe with 24 outlets, one of these was provided with a pressure gauge, the remainder with burners.

The average results of several trials on two individual regulators was as follows:

With a street pressure of ·35, and with 22 lights burning, the burner pressure was adjusted to ·5—20 lights were then extinguished when the burner pressure rose to ·6.

The following table exhibits the results under a varying pressure on the street main, with few and with many lights.

Pressure on Inlet to regulator in inches of water.	Pressure on Outlet to regulator; 2 burners lit, in inches of water.	Pressure on Outlet to regulator, 22 burners lit, in inches of water.
4·	0·5	0·5
3·5	+0·5	0·6
3·—	0·6	0·7
2·5	0·65	0·75
2·—	0·7	+0·8
1·5	+0 8	0·9
1·—	0·8	—0·9
0·75	—0·75	—0·7 supply insufficient.
0·5	—0·5 supply insufficient.	—0·4

An examination of these results shows, that as the street (or supply) pressure diminished, the burner pressure increased, until the supply became insufficient for the wants of the burners; at which point the burner pressure was exceeded by the street pressure, by the amount of friction produced by passing the regulator.

The cause of this over compensation may be traced as follows: The variations of pressure upon the inlet, produce corresponding variations of pressure upon the back of the valve; as the street pressure increases the valve should close, and in doing so, increase the tension of the spring by such quantity as exactly to balance the increased pressure upon the valve. The results obtained show that the tension of the spring was insufficient at high pressures upon the inlet, and too great at low pressures. In the one extreme the regulator throttled the flow, and in the other permitted too free a passage.

Although this instrument approximates to the results desired, it cannot be declared to be a perfect regulator. Such an one should maintain a constant outlet pressure, unaffected by change in consumption, or variations of supply.

By order of the Committee,

Philadelphia, August 14, 1856. WILLIAM HAMILTON, *Actuary.*

BIBLIOGRAPHICAL NOTICES.

The Art of Perfumery, and method of obtaining the Odors of Plants, with instructions for the manufacture of perfumes for the handkerchief, scented powders, perfumed soap, &c.; with an Appendix on the colors of flowers, artificial fruit, &c., &c. By G. W. SEPTIMUS PIESSE. Philadelphia: Lindsay & Blakiston, 1856.

This is a very interesting little memoir on the art of perfumery, including within its range the preparation of all toilet articles, such as scented soap, tooth powders, cosmetics, hair-dyes, &c., &c. It contains a brief description of the processes for obtaining the odoriferous principles of the flowers and other substances used; an alphabetical catalogue of the more useful essences, and a very extensive list of recipes for the compound extracts or bouquets, and other popular mixtures. The author is a German, as is manifested not only by his name, but by the very awkward style of his book, which once or twice becomes nearly incomprehensible. His practice seems to be English, at least he seems far more familiar with the practice of English perfumers.

The book itself bears internal evidence of being a re-print from an English one; although nothing of the kind is alluded to in the title page or preface. Thus we have on p. 112, a table of "Quantities of essential oils or ottos paying 1s. per pound duty, entered for home consumption, in the year 1852." And we are told that the total, 195,346 lbs. "at the duty of 1s. per lb., yield a revenue annually of £9766 16s." Again, on page 178, "Prior to the removal of the excise duty on soap in 1853, &c." The wood cuts illustrating soap making, too, look familiar to us, although an American device has taken the place of the European one on the soap mould.

In consequence of this foreign origin, no attention is called to our native flowers, many of which would probably furnish valuable novelties to our perfumers—such as a *Magnolia glauca*, *Epigæ repens*, and a list of others. Still, with these defects, the work contains a vast deal of valuable information, and may contribute to the pleasure and perhaps the profit of many of our readers. Ed.

A Treatise on Chemistry applied to the Manufacture of Soap and Candles; being a thorough exposition, in all their minutiæ, of the principles and practice of the trade, based upon the most recent discoveries in Science and Art. By Campbell Morfit, Professor of Chemistry in the University of Maryland. A new and improved edition, illustrated with two hundred and fifty engravings on wood. Philadelphia: Parry & M'Millan, 1856. One vol., royal 8vo. 600 pp.

This is a largely improved edition of a work under the same title, first published in 1847, by Carey & Hart; and as a hand-book of useful knowledge, it merits a first rank among treatises on the scientific arts. Not only does it embrace the practical details of the subject, but also its literature and science, and in such harmonious connexion as to render it no less interesting to the student, than valuable to the manufacturer. The author commences *ab initio*, and in terms concise and intelligible, sets forth the art from the very rudiments up to its nicest refinements, giving full explanations of the theory and practice of each step, *pari passu*. We know of no work that covers the same extent of instruction upon the subject, for it not only presents what is valuable of the past, but every useful result of recent discovery, so that it is literally posted to the date of publication.

It is not a mere foreign book with a new title, but an eminently American and original work, which will reflect honor upon the chemical arts of this country; and the publishers have done themselves credit in issuing it in an appropriate and elegant style. D.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

OCTOBER, 1856.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Measurement of the Speed of a Railway Train, by means of Electro-Magnetism. By Wm. C. McRea, Telegraphic Engineer.

The wheels of a car rotate a certain number of times in going over a given space of road ; for example, suppose a car-wheel to be eight feet in circumference, it will rotate 660 times in going the distance of a mile. Now, if the car were so constructed that the body would always remain at an equal distance from the axle, which is prevented by the motion given it by the springs, it would not be difficult to bring the wheel at each revolution to so bear upon a lever, as to rotate a wheel inside the car, which might have as many cogs as the car-wheel rotates times, in going a mile. Or, by a series of clock-work wheels, the indicating wheel might contain a fractional number of cogs in proportion to the number of times which the car-wheel would rotate in a given distance.

The difficulty occasioned by the unsteady motion of the car, owing to the springs, may be overcome by the use of a magnet, battery, and galvanic circuit. The latter to be so arranged as to be broken at each revolution of the car-wheel or axle. So by this means the operation of the magnetic contrivance would be to move the speed-indicator the distance of one cog.

A contrivance of this kind may be so constructed as not to require winding, in order to have it in readiness for use.

The indicator may be so constructed as to have an index placed over it, in such a position that the hand on the indicator should move it a sufficient distance to show at each successive rotation, the number of miles already traveled.

The kind of battery most suitable for such a contrivance, would be that of the "sand battery;" which, if properly constructed, may be made to act with as much certainty as any other, and at far less expense. This battery should be constructed with sand of such quality as is used by the manufacturers of glass, that is, free from dirt of any kind. The battery cup may be that of the ordinary kind, as used in Grove's battery, or if larger glass or porcelain jars can be obtained, they would doubtless be better, affording an opportunity for the use of larger plates of zinc and copper; these should be placed about an inch apart, and the sand packed tightly around them. The zinc should be amalgamated, and the copper rubbed with a piece of emery paper, before placing in the cup; the sand should then be well moistened with sulphuric acid, diluted in the usual proportion for battery purposes. Intensity may of course be increased by increase of acid. A battery of this kind would stand for some weeks, only requiring the addition of a little acid each day, according as the strength of that first put in, became exhausted. A series of cups of this kind could be carried on board of a train, without the difficulties which would arise from that of almost any other battery.

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*Siemens's Regenerative Steam Engine.** By C. W. Siemens, Esq., C. E.

Substance of a lecture recently delivered at the Royal Institution.

The steam engine of Watt was composed of four organic parts, namely —1. The furnace, or chamber of combustion, with its flues and chimney. 2. The boiler, or steam generator. 3. The steam vessel, or cylinder, wherein the elastic force of the steam is imparted to the piston, or other first moving parts of the machinery. 4. The condenser, where the elastic force of the steam is destroyed by abstracting its latent heat by injection of cold water, or by exposure of cooled metallic surfaces. In the case of high-pressure engines, it would seem that the condenser was suppressed; but it might be said that this class of engines makes use of one great common condenser, namely, the atmosphere, the separate condenser possessing only the advantage of relieving the working piston of the opposing atmospheric pressure. The only essential improvement of the steam engine that has been introduced since the time of Watt, consists in working the steam expansively, whereby a considerable economy has been obtained; but it is well known that Watt foresaw the advantages that would be realized in this direction.

The lofty superstructure proved the soundness of the foundation Watt had laid; and it would seem hopeless to change the same, unless it could be proved that the very principle regarding the nature of heat, whereon Watt had built, had given way to another more comprehensive principle. The engine of Watt was based upon the material theory of heat that prevailed at his time, and almost to the present day. According to this theory, steam was regarded as a chemical compound of

* From the Lond. Mech. Mag., July, 1856.

water, and the supposed imponderable fluid "heat," which possessed amongst others the property of occupying under atmospheric pressure nearly 1700 times the bulk of the water contained in it. The Boulton and Watt condensing engine took the full advantage of this augmentation of volume, which effected a proportionate displacement of piston, and the condensation of the steam obviated all existing pressure to the piston.

In the course of the last few years our views of the nature of heat had, however, undergone a complete change; and, according to the new "dynamic theory," heat, as well as electricity, light, sound, and chemical action, are regarded as different manifestations of motion between the intimate particles of matter, and can be expressed in equivalent values of palpable motion and dynamic effect. In support of this theory he (Mr. Siemens) could not do better than refer to the able discourses, recently delivered in the Royal Institution, by Mr. Grove and Professor Thomson.

Viewed from the position of the new theory, the heat given out in the condenser of a steam engine represented a loss of mechanical effect amounting to $\frac{13}{14}$th parts of the total heat imparted to the boiler, and the remaining $\frac{1}{14}$th part was all the heat really converted into mechanical effect. The greater proportion of the lost heat might be utilized by a perfect dynamic engine. A vast field for practical discovery was thus opened out; but it might yet be asked whether it was worth while to leave our present tried and approved forms of engines to seek for economy, however great, in a new direction, considering the vast extent of our coal fields. The reply to this objection was that the coal, in its transit from the pit to the furnace, acquired a considerable value, which, for this country, might be estimated at £8 per horse-power per annum (taking a consumption of 13½ tons of coal, at an average expenditure of 12*s*. per ton).

Estimating the total force of the stationary and locomotive engines employed in this country, at 1,000,000 nominal horse-power, it followed that the total expenditure for steam coal amounted to £8,000,000 sterling per annum, of which at least two-thirds might be saved. In other countries, where coal is scarce, the importance of economy becomes still more apparent; but it is of the highest importance for marine engines, the coals whereof had to be purchased at transatlantic stations, at a cost of several pounds per ton, to which must still be added the indirect cost of its carriage by the steamer itself in place of merchandize.

These observations, Mr. Siemens thought, might justify him in bringing before the Institution an engine, the result of nearly ten years' experimental researches, which he thought to be the first practical application of the dynamic theory of heat, of which he was proud to call himself an early disciple. Others, more able than himself, might probably have arrived sooner at a practically useful result; but he might claim for himself at least that strong conviction, approaching enthusiasm, which alone could have given him strength to combat successfully the general discouragement and the serious disappointments he met with.

This engine, of which several diagrams and a model were exhibited, consisted of three essential parts, namely, the furnace; the working cylinder, with its respirator and heating vessel; and the regenerative cylinder. It consisted also of a boiler and condenser (unless the steam were discharged into the atmosphere); but these were not essential to the working of the engine, although of great practical utility. The regenerative cylinder had for its object alternately to charge and discharge two working cylinders, and the action of its piston might be compared to that of a hammer oscillating between two elastic anvils. The regenerative cylinder communicated at its one extremity with one working cylinder, and at the other extremity with another and similar working cylinder, and these communications were not intercepted by valves. The working cylinders were so constituted that their capacity for steam of constant pressure was the same, no matter where the working piston stood. Each consisted of a cylinder of cast iron, open at both ends, which was completely enclosed in another cylinder or heating vessel, one end of which was exposed to the action of a fire. Within the inner cylinder was a large hollow piston, filled with non-conducting material, to which was attached a long trunk or enlarged hollow piston rod of nearly half the sectional area of the piston itself. This trunk was attached to the working crank of the engine in the usual manner. The trunk of the second working cylinder stood precisely opposite, and was connected with the same crank, The piston of the regenerative cylinder was also connected with the same crank, but stood at right angles to the two working cylinders. The consequence of this arrangement was, that while the two working trunks made their strokes (the one inward and the other outward), the piston of the regenerative cylinder remained comparatively quiescent upon its turning or dead point, and *vice versa.* Around the two heating vessels boilers were disposed, which received the heat of the fire after it had acted upon the former. The steam generated within the boilers was introduced into the engine by means of an ordinary slide valve (of comparatively very small dimensions,) at short intervals, and when the piston of the regenerative cylinder was in its extreme position. The admission of the steam, which was of high pressure, took place on that side of the regenerative cylinder where compression by the motion of its piston had already taken place, and at the same instant a corresponding escape of expanded steam on the other side of the regenerative piston was allowed to take place into the atmosphere. The quantity of steam freshly admitted at each stroke did, however, not exceed one-tenth part of the steam contained in the working cylinders of the engine, and served to renew the same by degrees, while it added its own expansive force to the effect of the engine. The compression of the steam into either of the working cylinders, took place when its hollow piston stood at the bottom. While in this position the steam occupied the annular chamber between the working trunk and the cylinder, besides the narrow space between the cylinder and the surrounding heating vessel. The pressure of the steam being the same above and below the hollow piston, but the effective area below being equal to twice the area above, the working trunk attached to the piston would be forced outward through the stuffing box, while the steam of the annular chamber above the piston passed through the narrow space intervening, into a space of twice the capacity of the annular chamber below the hollow piston. During its passage the steam had to traverse a mass of metallic wire gauze or plates, the respirator presenting a large aggregate surface, which reached at one end sufficiently downward into the heating vessel, that its temperature was raised from 600° to 700° Fahr., while its other extremity remained at the temperature of saturated steam, or about 250° Fahr. In consequence of the addition of temperature the steam received on its passage through the respirator, its elastic force was doubled, and it therefore filled the larger capacity below the hollow piston or displacer without loss of pressure. When the effective stroke of the working trunk was nearly completed, the regenerative piston commenced to recede, and the steam below the hollow piston expanded into the regenerative cylinder, depositing on its regress through the respirator the heat it had received on its egress through the same, less only the quantity that had been lost in its expansion below the working piston, and which was converted into dynamic effect or engine power, and which had to be supplied by the fire. The expansion and simultaneous reduction of temperature of the steam, caused a diminution of its pressure from four to nearly one atmosphere; and the working trunk could now effect its return stroke without opposing pressure, and while the second working trunk made its effective or outward stroke impelled by a pressure of four atmospheres.

The respirator which was invented by the Rev. Mr. Stirling, of Dundee, in 1816, fulfilled its office with surprising rapidity and perfection, if it were made of suitable proportions. Its action was proved at the end of the lecture by a working model. It had been applied without success to hot-air engines by Stirling and Ericsson, but failed for want of proper application; for it had been assumed (in accordance with the material theory of heat,) that it was capable of recovering all heat imparted to the air, and, in consequence, no sufficient provision of heating apparatus had been made. It having been found impossible to produce what, in effect, would have been a perpetual motion, the respirator had been discarded entirely, and was even now looked upon with great suspicion by engineers and men of science. Mr. Siemens had, however, no doubt that its real merits to recover heat that could not practically be converted by one single operation into mechanical effect, would be better appreciated. The rapidity with which the temperature of a volume of steam was raised from 250° to 650° Fahr. by means of a respirator, was indicated by the fact that he had obtained with his engines a velocity of 150 revolutions per minute. The single action of heating the steam occupied only a quarter the time of the entire revolution of the engine, and it followed that it was accomplished in one-tenth part of a second. But, in explanation of this phenomenon, it was contended that the transmitting of a given amount of heat from a hotter to a cooler body, was proportionate to the heating surface multiplied by the time occupied, and that the latter factor might be reduced *ad libitum*, by increasing the former proportionately. The air-engines of Stirling and Ericsson had failed also, because their heated cylinders had been rapidly destroyed by the fire: but the cause for this was, that an insufficient extent of heating surface had been provided ; and it was well known that even a steam boiler would be rapidly destroyed under such circumstances. Mr. Siemens was led by his own experience to believe that his heating vessels would last certainly from three to five years, and being only a piece of rough casting, that could be replaced in a few hours, and at a cost below that of a slight boiler repair, he considered that he had practically solved the difficulty arising from high temperature. It was, however, important to add, that all the working parts of his engine were at the temperature of saturated steam, and therefore in the same condition as ordinary steam engines; whereas in Ericsson's engine, the hot air had entered the working cylinder. In surrounding the heating vessel with the boiler, an excessive accumulation of heat was prevented from taking place, and the pressure of the steam in the boiler became the true index to the engine-driver of the temperature of the heating vessel. Another essential property of the heating vessel was, that all its parts should be free to expand by heat without straining other parts, which was accomplished by a free suspension, and by undulating its surface. Lastly, it should be massive, to stand the fire with impunity; for iron was, strictly speaking, a combustible material. The pyropherus, or finely divided metallic iron, took fire spontaneously on exposure to the atmosphere; a chip of iron was ignited in flying through the flame of a candle; an iron tea-kettle was destroyed by exposing it (unfilled with water) to a kitchen fire; whereas, in forging a crank-shaft, the solid mass of iron withstands the white heat of the forge-fire for several weeks without deteriorating. A heating vessel, properly constructed and protected, might be heated with safety to 700° Fahr., at which temperature it would be almost as able to resist pressure as at the ordinary temperature of the atmosphere, the point of maximum strength of iron being at 550° Fahr., as had been proved by experiments made for the Franklin Institution. The construction of a heating vessel combining these desiderata was of paramount importance for the success of Mr. Siemens's engine, and had not been accomplished without combatting against considerable practical difficulty.

Although heat may be entirely converted into mechanical effect, it would nevertheless be impossible to construct an engine capable of fulfilling this condition without causing at the same time a portion of heat to be transferred from a hotter to a cooler body, and which must ultimately be discharged. This necessity has been generally proved, and in a very elegant manner, by Professor Clausius, of Zurich, and implies at least the partial truth of "Carnot's theory." In the "regenerative steam engine," provision had been made for absorbing this quantity of heat, arising in this case from the circumstance that the saturated steam enters the respirator in a state of greatest density or compression, and returns through it (expanding into the regenerative cylinder,) at a gradually diminishing density, although the temperature of the extreme edges of the respirator remains proportionate to the condensing point of the steam of greatest density, by providing water chambers about the cover of the working cylinder, and around the regenerative cylinder, which are in communication with the steam boiler. The heat absorbed from the slightly superheated steam is thus rendered useful to generate fresh steam.

Objection had been raised by casual observers against the regenerative steam engine, on account of its apparent similarity in principle to the "air engines" of Stirling and Ericsson, implying similar sources of failure. The apparent similarity in principle arose from the circumstance that both Stirling and Ericsson, as well as himself, had employed the respirator and high temperatures; but these were subordinate means or appliances, that might be resorted to in carrying out a correct as well as an erroneous principle.

In the winter of 1852-53, when Ericsson was engaged upon his gigantic experiment in America, the speaker had had occasion to read a paper to the Institution of Civil Engineers, entitled, "On the Conversion of Heat into Mechanical Effect," wherein he had endeavored to set forth the causes of probable failure of that experiment, and to guard against a sweeping condemnation on that account of some of the means Ericsson had employed.

According to the dynamic theory of heat, the elastic medium employed in a perfect caloric engine was a matter of indifference, and air had been resorted to because it was perfectly elastic, and always at hand. In practice, however, the elastic medium employed was a matter of very great importance, and he (Mr. Siemens) had given the decided preference to steam, and for the following reasons:—

1. The co-efficient of expansion of saturated steam by heat exceeded that of air in the proportion of about 3 : 2, but decreased with an increase of temperature. This was not in accordance with the established rule by Guy Lussac and Dalton, but was the result of his own experiments (described in a paper, "on the expansion of steam, and the total heat of steam," communicated to the Institution of Mechanical Engineers, in 1850), and had been borne out by his practical experience on a large scale. Mr. Siemens had been first induced to undertake these experiments in consequence of an observation by Faraday, that the elastic force of the more permanent vapors gave way rapidly, when by abstraction of heat their point of condensation was nearly obtained. He conceived that gases and vapors would expand equally by heat, when compared, not indeed at the same temperature, but at temperatures equally removed from their points of condensation.

2. When saturated steam was compressed (within the regenerative cylinder), its temperature would not rise considerably (as the fire-syringe evinced in respect of air), because Regnault had proved that the total heat of steam increased with its density, and consequently the heat generated in compression was required by the denser steam to prevent its actual condensation. Without this fortunate circumstance, the steam would be heated already by compression to such an extent that it would be difficult indeed to double its elastic force by the further addition of heat in the respirator.

3. Steam exercised no chemical action upon the metal of the heating vessel and respirator, because the oxygen it contained was engaged by hydrogen, which latter had the stronger affinity for it until a white heat

was reached; whereas the free oxygen of atmospheric air attacked iron and brass at much lower temperatures.

4. The specific gravity of steam was only about one-half that of atmospheric air at equal temperature and pressure; moreover, it was a far better conductor of heat, and both circumstances qualified it for rapid respirative action.

5. The fresh steam required for starting and sustaining the power of the engine was generated by heat that would otherwise be lost. No air-pumps, &c., were required, and the management of the engine became as simple as that of an ordinary high-pressure steam engine.

In conclusion, it was stated that at present there were several regenerative engines in constant practical operation, in this country (at the works of Messrs. Newall & Co., at Gateshead), in France, and in Germany, varying from five to forty horse-power, which had proved the practicability of the principle involved, although they were still capable of improvement. Several other engines were now in course of construction at establishments celebrated for precision of execution, and with the advantage of Mr. Siemens's increased experience in designing them. He had been fortunate to meet with men of intelligence and enterprise, lately joined together in a public company, whose co-operation insured a more rapid development of his invention than individual effort could produce. The benefit he had hoped to derive from his discourse, incomplete as it necessarily was, would be realized, if those men, eminent in science, whom he saw around him, would accept his labors as an earnest towards the practical realization of the dynamical theory of heat, and hasten its triumphs by their own researches. It was impossible to over-estimate the benefits that mankind would derive from a motive force at one-third or one-fourth part the cost and incumbrance of the present steam engine. The total consumption of coal would certainly not diminish; but our powers of locomotion and production would be increased to an extent difficult to conceive, tending to relieve men from every kind of bodily toil, and hasten the advent of the hoped-for period of general enlightenment and comfort.

Economic Working of Steam.[*]

Sir—Having observed for some years, that the increase of pressure in the condenser of a steam engine does not decrease its economy in the same ratio that obtains between pressure in condenser and pressure on piston, I arrived at the conclusion that it was possible to find the maximum pressure in condenser that would give the maximum of economy when the mean effective pressure on the piston was given, the feed-water being forced into the boiler at the temperature due to pressure in condenser.

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[*] From the Lond. Civ. Eng. and Arch. Journ., August, 1856.

The two following statements are true when taken independent of each other.

1st. The nearer we approach to a pure vacuum in the condenser, the less will be the fuel used to drive the engine.

2d. The hotter the feed-water enters the boiler, the less will be the fuel required to convert that water into steam.

In the first, the amount of fuel used decreases with the decrease of pressure in the condenser; in the second, the amount of fuel used decreases with the increase of temperature of the water in the condenser, when said water is used to feed the boiler. Hence, there is a temperature and pressure in the condenser at which the greatest economical effect is produced.

In order to ascertain this, let T = total heat of steam in boiler; t = temperature of steam in condenser; P = mean pressure of steam acting upon a piston in pounds per square inch; p = pressure of steam in the condenser in pounds per square inch.

Then the ratio of effect will be for pressure $\frac{p}{P}$, and that for temperature $\frac{t}{T}$; the maximum of economy will be obtained when

$$\frac{p}{P} = \frac{t}{T} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (1)$$

But t and p are unknown, whilst P and T are known. And in order to find t and p, another equation containing them must be produced; this is furnished by Southern's formula for pressures less than the atmosphere—namely:

$$p = \cdot04948 + \left(\frac{51\cdot3 + t}{155\cdot7256}\right)^{5\cdot13} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (2)$$

$$\text{Also } p = \frac{t\,P}{T} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (3)$$

by transposing equation (1). Therefore,

$$\frac{t\,P}{T} = \cdot04948 + \left(\frac{51\cdot3 + t}{155\cdot7256}\right)^{5\cdot13}$$

And since the temperature in the condenser will not be much affected by the quantity ·04948, it may be neglected; then by transposition we get

$$\frac{P}{T} = \left(\frac{51\cdot3 + t}{155\cdot7256}\right)^{5\cdot13} \div t.$$

Giving this last equation a logarithmic form, we have
log. P — log. T = 5·13 [log. (51·3 + t) — log. 155·7256] — log. t. From which the value of t may be found for any value of P, by any of the methods of approximation. Double Position is perhaps the simplest plan, and is the one I have adopted in order to get the values shown in the following tables.

By assuming any value for P, that of T is found by the formula given by Regnault, viz:

$$(t' = 32^\circ)\ \cdot305 + 1123\cdot7 = T,$$

where t is the temperature Fahrenheit corresponding to the pressure P

of the steam in the boiler including the atmosphere. When t is found, p may be found by Equation (3).

The following table shows the temperature and pressure in the condenser when P varies from 30 lbs. to 6 lbs. upon the square inch. If the pressure in the boiler be increased to 70 lbs. or decreased to 20 lbs., the values of t and p will not be much changed, since T varies very little from the value in the table for these pressures.

Pressure in boiler = 40 lbs. above the atmosphere ∴ T = 1202° Fah.			Most economical pressure in condenser by Indicator.
P	t	p	15—p.
lbs.	Temperature Fah.	lbs.	
30	150·5	3·72	11·28
28	146·5	3·36	11·63
26	141·9	3·02	11·98
25	140·6	2·92	12·1
24	138·6	2·73	12·27
22	134·8	2·48	12·52
20	129·6	2·14	12·86
18	125·6	1·9	13·1
16	119·	1·64	13·36
14	113·	1·38	13·62
12	105·	1·09	13·96
10	98·7	·89	14·11
8	92·5	·73	14·27
6	84·	·57	14·43

This table shows that as the mean pressure on the piston increases, the pressure in the condenser increases also, when the economical effect is a maximum; and if we increase the mean pressure still further, we soon find that condensers with pressures equal to and above the atmosphere may be used with advantage, as shown by the next table.

Pressure in boiler=55 lbs. including the atmosphere ∴ T=1202° Fah.			Pressure in boiler=85lbs., including the atmosphere ∴ T = 1211° Fah.		
P	t	p	P	t	p
40	166	5·52	60	189	9·36
50	179	7·44	70	199	11·5
			80	208	13·74
			84·5	212	14·8

The above table shows that it is not essential that an air pump and condenser of the present construction is required in order to obtain the most economical result.

If condensation near the atmospheric pressure be adopted, the temperature of the feed water may be 212° Fah., which will dispense with the air-pump altogether, at the same time saving a great amount of unnecessary power, and consequently a great amount of fuel. And since the steam used will be of a higher pressure, the diameter of the cylinder may be much reduced, and considerable economy will be the result.

Steam of 37 lbs., including atmosphere, is 6 per cent. cheaper than steam of atmospheric pressure.

Steam of	42 lbs.	is 7	per cent.	cheaper.
"	48 lbs.	8	"	"
"	55 lbs.	9	"	"
"	63 lbs.	10	"	"
"	70 lbs.	11	"	"
"	79 lbs.	12	"	"
"	87 lbs.	13	"	"
"	100 lbs.	14	"	"
"	110 lbs.	15	"	"
"	120 lbs.	16	"	"

By dispensing with the air pump, and using high steam, independent of expansion, a saving of about 15 per cent. may be expected. Where new steam engines are to be erected, a very great saving in the first cost will be obtained, and a great amount of space saved.

THOMAS BALDWIN, C. E.

Corn Market Buildings, *Bury*, *Lancashire*, *July* 3, 1856.

*On the Construction of Packing Rings for Pistons.** By Mr. JAMES RAMSBOTTOM.

The writer of the present paper—having invented a few years ago a metallic piston, the packing of which is forced against the working surface of the cylinder by its own elasticity, and owing to its being comparatively slender in cross section, had to be left about 10 per cent. larger in diameter than the block of the piston, to give the requisite pressure for preventing the passage of steam—found, that when such packing was made of a circular figure before being compressed, it was invariably worn more rapidly at the joint, and at the part opposite the joint, than at the intermediate parts. It is very natural that this should be the case, and it has been the practice with many engineers, when using packing rings which are pressed against the cylinder by their own elasticity alone, to make the part opposite the joint, where there is clearly the most strain, stronger than any other; each half being tapered off to the joint: this has not however been done by any positive rule.

It was taken for granted that the unequal wear above referred to was owing to the pressure against the cylinder being unequal in different parts of the ring; and as the packing rings used by the writer are made of wire or drawn rods, and consequently uniform in thickness, it was found impracticable to ensure this equable pressure by tapering the ring; but as this uniform pressure can be obtained by making the packing ring truly circular in figure, but unequal in thickness, it occurred to the writer, inasmuch as the rings which he employs are bent and not turned, that the same end might be gained, by conversely making the ring equal in strength of material, but unequal in figure; or in other words, that a ring might be made of such a shape, that although uniform in cross section, it would press equally against the working surface of the cylinder all round.

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* From Newton's Lond. Journ., August, 1856.

It may be possible to determine geometrically the form of ring required, but the writer preferred to solve the question in a practical manner by the following method:—A ring was first bent truly circular in shape, and of a diameter exactly equal to that of the piston for which it was intended—the ends just touching at the joint, but without pressure: this ring was then placed upon a circular table, and concentric therewith; and a number of strings, say twenty-four in all, were attached at equal distances apart round the circumference, and passed over the same number of small pulleys which were fixed at equal distances round the edge of the table. To these strings were attached equal weights, which, acting upon equal portions of the circumference of the circular ring, brought it into an oblong shape. The writer then conceived that if a true circle were brought into this shape, when subjected to equal radial forces acting upon equal portions of its circumference, another ring bent to the figure so obtained would conversely be brought to a truly circular shape by the application of equal forces acting in the opposite direction, that is, towards the centre instead of from it; and practice has proved that such a conclusion was correct; for a ring so bent is found to wear equally throughout, and to last much longer than those originally made circular in figure.

In trying these experiments, an important fact has been accidentally discovered, namely, that the force required to keep the packing in contact with the working surface of the cylinder, even at pressures exceeding 100 lbs. per square inch, is much less than is generally supposed. It has been argued that the pressure per square inch on the rubbing surface must be at least equal to the steam pressure which has to be resisted; but so far from this being the case, experiment has led the writer to the conclusion, that as respects the pistons of locomotive engines, this need not exceed 3½ pounds per square inch of rubbing surface, even when the rings are new and exerting their maximum force; and as these packing rings are practically steam-tight until half worn, it follows that the average pressure upon the working surface of the cylinder does not amount to three lbs. per square inch. This slight pressure, taken in connexion with the small amount of rubbing surface, is sufficient to account for the satisfactory performance of this description of packing.

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The apparatus for ascertaining the correct curve for the piston rings was shown in operation; and two sets of rings that had been curved on the improved plan, and had worked in two pairs of pistons for 12,694 and 10,012 miles respectively, were exhibited, showing a very uniform wear of the rings throughout their length.

Mr. Joy observed that he had found a long and light elasticity was the right plan for the packing of a piston; and the results of his experience confirmed the statement in the paper, as to a very light pressure of the packing rings, not exceeding three or four lbs. per square inch upon the cylinder surface, being quite sufficient to keep them steam-tight if free in their action; and the consequence was, a very considerable saving in the friction of the pistons over the ordinary kinds of metallic packing.

The Chairman said his object in the paper had been merely to show the practical way in which the practical difficulty had been surmounted. The result of the improved form of packing rings had been very satisfactory; and about double the mileage was now obtained from the same thickness of rings, compared to the former results, owing to their wear being nearly uniform throughout their whole length.

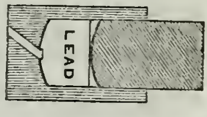
For the Journal of the Franklin Institute.

On Neutralizing the Force of Collisions of Locomotive Engines.

I saw a communication in the "*Ledger*" a few weeks since, from a gentleman, whose name I have unfortunately forgotten, on the subject of neutralizing the force of collisions of locomotive engines.

He instanced the effect of introducing heated metal under a forge hammer, which would prevent the destructive action of the hammer upon the anvil under blows of any force; and proposed the interposition of some material which would pack or crush to receive the shock of the collision of two locomotives.

This suggested to me the idea of forming bumpers for locomotives, upon the principle of the reverse action of hydrostatic presses, and substituting cold lead for the water. Upon this plan, any desired amount of *yielding* resistance can be obtained, by increasing the diameter of the plunger in proportion to the diameter of the aperture through which the cold lead would be forced by the action of the collision upon the plungers, like meat through a "sausage stuffer." The interior of the bumper would be a hollow cylinder, terminating in a cone or portion of a sphere, with a small aperture; and the plunger would be made exactly to fit it.



The rounded or conical end of the plunger would first impinge upon the flat surface of the lead, in the cylinder, and operate like a spring, gradually increasing the resistance up to the maximum, when the lead would commence passing through the aperture, and continue a *yielding* resistance at that pressure, until the whole of it would be expelled from the cylinder, should the momentum of the collision not be previously balanced.

Erskine Hazard.

Philadelphia, August 26, 1856.

AMERICAN PATENTS.

List of American Patents which issued from July 29th, to August 26th, 1856, *(inclusive,) with Exemplifications.*

JULY 29.

190. For an *Improvement in Pegging Jacks;* Alfred Bailey, Amesbury, Mass.

Claim.—"1st, The application of a spiral or other spring, to hold the last firmly in its place, and at the same time, allow the head pieces to be put in any desired position. without re-adjusting the last or spring. 2d, The arrangement by which the vertical head may be turned vertically above the axis upon which it turns horizontally."

191. For an *Improvement in Portable Folding Tables;* C. D. Barnitz, Baltimore, Md.

Claim.—"The movable braces and supports, which, when in a horizontal position, brace firmly the legs in an upright position, and also give support to the lids, and when turned into a vertical position, permit the legs to close in against the under surface of the table."

192. For an *Improvement in Raking Apparatus of Corn and Cane Harvesters;* John W. Batson, Triadelphia, Md., Assignor to self and Martin H. Batson, Maryland.

Claim.—"In combination with the endless rake belts, passing under and over the platform, and thence over the pulleys, the shield placed between them, when said shield receives the corn or cane from the rakes, at their highest elevation, and conveys it into a wagon, or other receptacle alongside."

193. For an *Improvement in the Cutting Apparatus of Corn and Cane Planters;* John W. Batson, Triadelphia, Md., Assignor to self and Martin H. Batson, Md.

Claim.—"The double angle V shaped cutters, composed of strips and under supports. Also, hanging said cutters to a pivoted bar, so that they may be raised up out of cutting position, when the machine is drawn through the stubble, to prevent their catching against the previously cut corn or cane."

194. For an *Improvement in Machines for Sawing Stone in Taper Form;* H. J. Behrens, City of New York.

Claim.—"Giving to a saw, placed in a line inclined to the line of motion of the saw frame, a lateral motion independent of the motion of the frame, or at right angles to the line of motion thereof."

195. For an *Improvement in Apparatus for Solar Salt Evaporation;* J. T. Boynton, Syracuse, New York.

Claim.—"The use and application of the covers of the salt vats, for the evaporation of salt water by solar influence."

196. For an *Improvement in Churns;* W. H. Burnham and B. Hibbard, Cortlandt, New York.

Claim.—"Our improved churn dasher, composed of two independent frames, combined with each other and with the operating lever."

197. For an *Improvement in Metal Planers;* E. C. Cleveland, Worcester, Mass.

Claim.—"The friction box attached to the shaft, and provided with adjustable dogs; the box being connected with the shaft by the gearing, and operating conjointly with the gearing and pawl on the shaft, and the arm which projects over the box."

198. For an *Improvement in Sawing Machinery;* A. S. T. Copeland, Pittsburgh, Pa.

Claim.—"The saw-heads and saw-strainers, and the combination of said saw-heads and strainers with the screw-nuts and screws. Also, attaching of saw-heads to pitman. Also, the combination of belt reversers with the mechanism for starting and stopping saws, and reversing pitman and circular saw shafts. Also, by reversers."

199. For an *Improvement in Harness for Weaving Seamless Bags;* Algernon S. Cole, Windham, Maine.

Claim.—"The application to weavers' harness, the addition of one row of heddle eyes, making two rows instead of one, upon each leaf of harness."

200. For an *Improved Shutter Operator;* James R. Creighton, Boston, Mass.

Claim.—"The attachment of the serrated tumbler catch to the slide, said catch meshing or interlocking with a similarly serrated or toothed surface, opposed on the side of the slide box, or frame box, in combination with the square extension rod and guides, by which I am enabled to operate the outside blinds or shutters of a house from the inside of the same, and to secure said blinds or shutters in any position, without the liability of their dislodgement from the outside, unless by the exercise of unusual violence."

201. For an *Improved Fountain Pen;* Austin G. Day, Seymour, Connecticut.

Claim.—"The sliding feed tube, having an aperture near its upper end, through which the ink flows, when the pen is in use; the aperture being closed, and the ink excluded from the feeding tube, by drawing it downwards into the lower end of the ink chamber. Also, the combination of the air hole or vent with the sliding feeding tube, the enlarged end of which closes the vent hole when the feeding tube is drawn down to stop the flow of ink to the pen."

202. For an *Improvement in Pyrogenous Lubricating Oils;* Samuel Downer and Joshua Merrill, Boston, Massachusetts.

Claim.—"The improvement of dissolving elastic bitumens, caoutchouc, or gutta percha, in the pyrogenic oils, used as lubricators."

203. For an *Improvement in Machines for Sawing Marble;* Lewis S. Fisher, Waynesboro', Pennsylvania.

Claim.—"Operating the saws by racks and cog wheel, in combination with the guides."

204. For an *Improvement in Fore and Aft Rig of Vessels;* George W. Gerau, Brooklyn, New York.

Claim.—"Constructing the mainsail, and having the lower end of the topsail attached to the outer end of the boom."

205. For an *Improvement in Sugar Evaporators;* Samuel H. Gilman, New Orleans, Louisiana.

Claim.—"The combination of the long kettle with the train of kettles; the pipe, the serpentine channel, and the fire flues. Also, the combination of the troughs with the train of kettles and the long kettle."

206. For an *Improvement in Bake Ovens;* John P. Hayes, Philadelphia, Penna.

Claim.—"The heating flues, arranged so as to cause the products of combustion to pass from the fire chamber below, first into the lower flue; thence behind its position, and out; thence, into the next flue above, and out; and so on through the successive flues which may be above, to the escape flue; the said flues being arranged on the two sides of the casing, and divided by the partition, and the products of combustion being directed thereby; together with the the partition plates in the wall."

207. For *Improved Devices in Stave Machinery;* Charles Hoyt, West Aurora, Illinois.

Claim.—"1st, Adjusting the staves in line with the feed rollers and jaws, by means of the sliding bed or plate, and laterally sliding plates. 2d, The feeding block, when operated by the spring, lever, and eccentric."

208. For an *Improvement in Steam Boiler Furnaces;* E. T. Ingalls, Haverhill, Mass.

Claim.—"The improvement in steam boilers, which consists in arranging a fire pot of sufficient depth to contain a large quantity of fuel, within or about and underneath the boiler, placed concentrically therewith, in such a manner, as to keep the fuel which is in contact with the lower part of the furnace, in a full state of combustion always."

209. For an *Improved Method of "Patching" Rifle Shot;* Ralph H. Isham, Greenwich, Connecticut.

Claim.—"The use of a leaden ball or bullet, of any desirable form, with a metallic case, or coating of brass or other firm metal, in whole or in part, whether plated, washed, or galvanized, or by whatever mechanical device the coating or partial coating may be effected for the use and objects of this invention."

210. For an *Improvement in Corn Planters;* James D. Jeffers, Joseph Sparks, and John H. Jeffers, Philadelphia, Pennsylvania.

Claim.—"1st, The moving, inclined planes, and spring, when constructed and combined, so as to operate together within the grain adjusting recesses. 2d, The stationary inclined planes, when operating in combination with the said recesses."

211. For an *Improved Clamp for Plumbers;* F. R. Langwith, City of New York.

Claim.—"The combination and arrangement of the clamp box, the clamping levers (when either is used), and, also, in combination therewith, the screws for adjusting the cock in a proper position, during the process of soldering with the main pipe."

212. For an *Improved Portable Printing Press;* Samuel W. Lowe, Philadelphia, Pa.

Claim.—"1st, The adjusting of the conical roller by means of the screw. 2d, The radiating lever, with its conical roller, in combination with the tympan and its spring."

213. For an *Improved Stave Machine;* John McMurtry, Fayette County, Kentucky.

Claim.—"The combination of the endless chain, or its equivalent, with the undulating bed or bearing, and the combination of these two devices with the planes for dressing the outer surface, and beveling the two edges to suit any size cask required. Also, the obtuse joint in the endless chain, at the carrying wheel."

214. For an *Improved Method of Inserting Faucets into Fluids under Pressure;* Patrick Mihan, Boston, Massachusetts.

Claim.—"The faucet receiver, as composed of the socket tube; and the perforated thimble, applied together by means of screws, and operated by the action of the faucets."

215. For an *Improvement in Hand Seed Planters;* A. C. Miller, Morgantown, Va.

Claim.—"In combination with the reciprocating agitators, the stationary but adjustable seed bar, with its wedge-shaped openings, and inclined sides, for the purpose of sowing seed broadcast, and adjusting the machine to the quantity or kind of seeds to be sown."

216. For an *Improvement in Soap Boiling Apparatus;* Campbell Morfit, Baltimore, Maryland.

Claim.—"The combination of the hollow shaft and tubular arms as a mixing, stirring, and heating twirl for 'dry' steam, either in open or closed vessels."

217. For an *Improvement in Potato Planters;* John Moore, Quincy Point, Mass.

Claim.—"Arranging and combining with the chambered cylinder and its spring guards, and so as to operate therewith a series of scrapers."

218. For an *Improvement in Coal Scuttles;* James Myers, Jr., City of New York.

Claim.—"Constructing the scuttle with a cast iron chambered or dish-shaped bottom, having a supporting flanch, in conjunction with and attached to the sheet or wrought iron sides of the body of the scuttle."

219. For an *Improvement in Knitting Machines;* John Nesmith, Lowell, Mass.

Claim.—"The lowering or raising the ends of the needles which receive the threads, so that the thread will not enter the hooks of the needles when out of their working line, as the carrier passes them, while the other ends of the needles remain connected with the mechanical arrangement used for pushing them forward and drawing them back, to form the stitch on their lines. Also, the slides, or their mechanical equivalents, for taking the needles out of the work for narrowing the fabric, and bringing them back into the work for widening the fabric. Also, the metallic rests or guards, or their equivalents, for constantly keeping a number of the needles in their working line. Also, the connexion of a registering or measuring apparatus, with the moving parts of my machine, for the purpose of bringing into use and taking out of use, the requisite needles at the proper time of shaping the fabric, and for severing the thread when the work is done, and stopping the machine when required. Also, the arrangement and movement of the finned bar, or its mechanical equivalent, to aid in forming the stitch. Also, its movement backward to uncover the ends of the needles, for putting on the new fabric."

220. For an *Improved Printing Press;* Thomas and Alfred Parkes, Brooklyn, N. Y.

Claim.—"1st, The cylinder, having flat surfaces on its periphery to receive the forms, in combination with the printing cylinders, placed in sliding bearings. 2d, The reciprocating shafts with the tapes, whereby the two printing cylinders are fed from one feed board, and the sheets therefrom, when printed on both sides, deposited upon one and the same fly board. 3d, The sliding frame, whereby the motion of the belt is reversed at the proper time, and also stopped at proper intervals; and the shaft raised and lowered for the purpose of reversing the movement of the sheets, and causing them to be printed on both sides."

221. For an *Improvement in Sawing Machines;* T. T. Prosser, Oconomowock, Wis.

Claim.—"The levers, pivoted or attached to the upright; the saw being placed at one end of the levers, and the levers adjusted by the bars and set screws at the opposite end."

222. For an *Improvement in Gutta Percha Apparatus for Covering Wire;* James Reynolds, City of New York.

Claim.—"1st, Providing the cylinder, or other vessel in which the gutta percha is submitted to the pressure, with a connexion to an air pump, or other suitable exhausting apparatus. 2d, The arrangement of the die and core or core piece, transversely to the direction in which works the piston or other device for producing the pressure. 3d, Providing the stomach, which contains the die, with a variable escape opening. 4th, The continuously revolving water trough, arranged relatively to the die."

223. For a *Pick-Pocket Detector;* Solomon W. Ruggles, Fitchburgh, Massachusetts.

Claim.—"Suspending the alarm detector, or instrument proper, including the case and its work parts, by the cord or chain, from or through the spring barrel, for alternate operation of the cord and bell-hammer by said barrel, in relation to the case."

224. For *Improved Devices in Carving Wood;* Nelson Ruger, West Farms, N. Y.

Claim.—"1st, The cutters, in combination with the bars, having arms attached to them—the arms having bars pivoted or jointed to their outer ends, to which the cutters and tracer are attached. 2d, The bar placed on a rod, which is attached horizontally to the vertical bar; the ends of the bar fitting between the arms."

225. For an *Improvement in Smut Machines;* G. H. Starbuck and L. D. Gilman, Troy, New York.

Claim.—"The combination of the screen, plate, funnels, and disk, with spike attached, when said plates are attached to the shaft, and fitted within the case or shell."

226. For an *Improvement in Machinery for Forming Hat Bodies;* Alva B. Taylor, Newark, New Jersey.

Claim—"The combination of a perforated cone picking apparatus and feeding apparatus. The combination with a main picking cylinder, of a secondary picking cylinder. The pyramidal draft box, in combination with a fan case for generating the currents of air.

227. For an *Improvement in Ox Yokes;* Miron Smith, Sandisfield, Mass.

Claim.—"The adjustable fulcrum block, in combination with the bow slides."

228. For an *Improved Method of Turning Ellipsoidal Forms;* G. W. Walton and H. Edgarton, Wilmington, Delaware.

Claim.—"The feed rollers and expanding cutters—one or more, attached or fitted to the hollow shaft."

229. For an *Improved Machine for Manufacturing Spools;* Augustus D. Waymoth, Fitchburgh, Massachusetts.

Claim.—"Combining the rounding, severing, and body cutters, with a carriage made to slide between the chuck and boring carriage, and in line with the latter, and so as to be moved toward the chuck by the boring carriage, while it is moved toward the work. Also, arranging the body and severing cutters, and combining them with the cutter carriage, by means of a turning holder, whereby the said cutters may be made to operate and put in operation."

230. For an *Improved Mode of Hanging Window Sash;* Cromwell P. Weaver, Philadelphia, Pennsylvania.

Claim.—"The employment in connexion with window frames and sashes, of the sliding bars."

231. For an *Improvement in Apparatus for Purifying White Oxide of Zinc;* Joseph Wharton, Philadelphia, Pennsylvania.

Claim.—"Cooling white oxide of zinc, and separating it from impurities, by causing the products of the furnaces to impinge successively upon a surface of water."

232. For an *Improvement in Clover Seed Harvesters;* C. B. Wheeler and A. Bascom, Steuben, Ohio.

Claim.—"The reel and cutters or teeth, placed within the sliding or adjustable frame, in combination with the endless apron."

233. For an *Improvement in Sad-iron Heaters;* Benjamin F. Wheelock, Mayville, Wisconsin.

Claim.—"The use or application of the chains, in combination with the table and lids, made to balance on the ears."

234. For an *Improvement in Machines for Binding Grain, &c.;* Washington F. Pagett, Stone Bridge, Virginia.

Claim.—"1st, The way, in combination with the slide, or its equivalent. 2d, The band, in connexion with the way and slide."

235. For an *Improvement in Machines for Cutting out Soles of Boots and Shoes;* James W. Wilder, Boston, Massachusetts.

Claim.—"Arranging and vibrating the knives around the cutters."

236. For an *Improvement in Apparatus for Smoking Meats;* John Wright, Wilmington, Delaware.

Claim.—"The application to furnaces of smoke houses, a back plate of iron or other incombustible material, forming an air chamber which will increase the draft of the furnace, and prevent any smoke from being wasted or lost, and also the application of inclined flues made of brick, iron, earthenware, or any other incombustible material—together with the smoke spreader, for the purpose of smoking meats, &c., the furnaces being upon the outside of the building."

237. For an *Improvement in Cultivators;* Jacob Zimerman, Oswego, Illinois.

Claim.—"The revolving rake and clearer, in combination with the series of elastic cutters and flat cutters."

238. For an *Improvement in Moulds for Hollow Projectiles;* Ethan Allen, Worcester, Massachusetts.

Claim.—"Cutting off the sprue, by means of a cutter working on the curve of the inner surface of the ball, so as to leave the ball smooth and symmetrical."

239. For an *Improvement in Flour Bolts;* S. C. Mendenhall and J. Conner, Richmond, Indiana.

Claim.—"The manner of varying the action of the revolving brushes, by giving to the brush bars, any backward or forward regular set on the radial arms or bosses, which carry the brush bars, in relation to the run or travel of the same within the screen cylinder, by means of the links connecting the inclined pivots or rods of the brush bars with a turning ring, arranged to revolve together with the brush shaft, but made capable of circular adjustment thereon. 2d, In combination with the radial expansion and contraction of the brush bars and brushes, within or against the screen cylinder for graduating the rub of the brush, giving any varied annular set backward or forward to such graduated rub, by so connecting the brush bars with the devices which effect the expansion or contraction as to admit of a variable inclined set or position, in relation to the run being given the said brush bars and brushes, to adjust or improve the action of said radially graduated rub."

240. For an *Improved Face-plate for Locks;* Thos. B. Atterbury and William Warwick, Assignors to Warwick, Atterbury & Co., Pittsburgh, Pennsylvania.

Claim.—"The separate or distinct guards or face-plate, of such a form in relation to case or skeleton frame of a lock or other fastening, that it may be put on either of the two sides of the said case or frame, whereby either of the sides can be made the face of the said lock or fastening."

241. For an *Improvement in Bee Hives;* J. S. Brown, Washington, D. C., Assignor to Joseph Kent, Baltimore, Maryland.

Claim.—"The peculiar construction of the drawer and its arrangement, in combination with the basement and bottom of the hive, so as to be reversible in position, and to serve the several purposes of a controllable ventilator, filth receptacle, with moth trap and feeding chamber."

242. For an *Improvement in Chimney Dampers;* Theodore F. Engelbrecht, Assignor to self and Thomas C. Nye. City of New York.

Claim.—"The supplemental perforations, consisting of the suspended conical deflectors."

243. For an *Improved Faucet;* Joseph Goodridge, Assignor to the Boston Faucet Company, Boston, Massachusetts.

Claim.—"So combining with the valve and its stem the dove-tailed recess, the expander, and a shoulder and screws, or the equivalents thereof, whereby the foot of the spring packing may be fastened into the valve."

244. For an *Improvement in Whiffle-Trees;* George Kenny, Milford, N. H., Assignor to self and George N. Davis, Boston, Massachusetts.

Claim.—"The combination of rubber washers with the whiffle-tree and about the king bolt, and the boxes arranged with the same, so as to protect the rubber and boxes from the entrance of water, dirt, &c., and thereby preventing the wear of the parts."

245. For an *Improvement in Whiffle-Trees;* George Kenny, Milford, N. H., Assignor to self and George N. Davis, Boston, Massachusetts.

Claim.—"The combination of rubber about the bolt on which the whiffle-tree turns, within the cylindrical strap and between the braces, so that it may be compressed, and thereby operate as a spring as well as serve to keep out the dirt, and prevent the wear and noise."

246. For an *Improvement in Pegging Jacks;* Alfred Swingle, Assignor to Elmer Townsend, Boston, Massachusetts.

Claim.—"The arrangement and application of the trammel or grooved cross, its slide bar and guide pins, the last holder and its sustaining arm, the same enabling advantages or new and useful effects to be attained."

247. For an *Improved Method of Operating Gates for Water Wheels;* John C. Shorey, Assignor to self and Augustus J. Webster, Rochester, N. H.

Claim.—"Applying the two gates to the wheel and flume, in manner and so as to operate with respect to the discharging spring and the wheel shaft."

Additional Improvements.

1. For *Improved Protecting Bulwarks for War Vessels;* William Ballard, City of New York; patented Nov. 1, 1853; additional, dated July 1, 1856.

Claim.—"The pannels and stancheons as arranged in relation to the promenade deck and bulwarks of the vessel."

2. For an *Improvement in Looms;* James O. Leach, Ballston, New York; patented Oct. 30, 1855; additional, dated July 8, 1856.

Claim.—"The employment of two sets of cams, four in each set, constructed, shaped, and arranged in reference to each other, the same being movable to the right and left without changing their intervals, and in either position producing a tubular cloth, one set being arranged in reference to the other, so that the shift of the cams shall make the harness shift the warp, instantly carrying that part forming the upper web downward, and that forming the lower web upward, making at their crossing a firm single joint."

3. For an *Improved Method of Regulating Pumps by Wind Wheels;* Jacob W. Goodwin and Moses C. Hawkins, Edenborough, Pennsylvania; patented April 8, 1856; additional, dated July 15, 1856.

Claim.—"1st. Constructing the wind wheel so that the shaft will turn with it, together with the manner of braking or stopping the wheel when the water cistern is filled with water, by means of the hydrostatic bellows, and the lever, and the brake blocks. 2d, The construction of the friction wheel, in combination with the friction wheel and the brake."

4. For an *Improved Gas Heater;* William F. Shaw, Boston, Mass.; patented January 23, 1855; additional, dated July 22, 1856.

Claim.—"The arrangement of a separate or boiling chamber, that is, to or between the flue pipe and the reverberating dome or space."

RE-ISSUES FOR JULY, 1856.

1. For an *Improvement in Spirit Levels;* Sylvester S. Sherman, City of New York; patented July 19, 1853; re-issued July 1, 1856.

Claim.—"The spring catch to hold the level in place upon the square or ruler, in combination with the bearers, the latter being so formed in respect to the level, that when they are placed upon a horizontal line, the bubble will be in the middle of the glass, and thus a horizontal or vertical line may be ascertained from a ruler or from a square when said level is attached."

2. For an *Improvement in Securing Pinions, &c., of Watches in Lathes;* James M. Bottum, City of New York.; patented July 15, 1851; re-issued July 8, 1856.

Claim.—"The employment of adhesive cement for securing staffs and pinions of watches and like articles of small dimensions for lathe operations, in combination with a chuck having a female centre therein, either with or without the tube."

3. For an *Improvement in Grain and Grass Harvesters;* Eliakim B. Forbush, Buffalo, New York; patented July 20, 1852; re-issued July 8, 1856.

Claim.—"1st, Extending or widening out the guard finger. 2d, Dropping that part of the frame (herein called the clamp) down the guard. 3d, The mould board. 4th. The arrangement and combination of a right angled stanchion, made of wood or metal, with a pivoted motion on the frame work of the machine, and supporting upon its upright part a lever, made of wood or metal, with a pivoted motion on the said stanchion, (or post,) to which lever is attached a rake."

4. For an *Improvement in Sowing Machines;* Pierpont Seymour, East Bloomfield, N. York; patented May 7, 1845; re-issued July 15, 1856.

Claim.—"The manner in which I have combined the stirring rod or bar, with the dropping bar or vibrating bar, and in combination therewith the gauge rod with its index for regulating the amount of seed to be dropped. Also, the lever, with a movable pin or fulcrum operated by the zig-zag motion for working the vibrating rods, and regulating the quantity per acre to be sown by increasing or decreasing the motion of the vibrating rod."

5. For an *Improvement in Machinery for Filling Seine Needles;* H M. Glines, Assignor to J. M. and S. F. Stanton, Manchester, N. H., Assignors to P. Bennett, J. Kendrick & L. A. Cook, Providence, R. I.; patented October 2, 1855; re-issued July 15, 1856.

Claim.—"Imparting to the needle and to the arm the motions for carrying the twine, cord, or thread, into the eye of the needle, around the tongue, and then out of the eye."

6. For an *Improvement in Cotton Gins;* David G. Olmstead, Vicksburg, Miss., Assignee of R. A L. McCurdy, Sabine Parish, La.; patented June 26, 1855; re-issued July 15, 1856.

Claim.—"The revolving screen situated in the hopper or 'roll box.' Also, the revolving screen. Also, the spirally winged shaft, revolving within said screen."

7. For an *Improved Metallic Pen;* Adam W. Rapp, Philadelphia, Penna.; patented January 6, 1852; re-issued July 22, 1856.

Claim.—"Reducing or thinning the sides of the pen between the shoulder and split, whereby advantages are freely attained, and the metallic pen made to possess the qualities of the quill pen.

8. For an *Improved Machine for Raking and Loading Hay;* Joseph Smith, Condit, Ohio; patented June 3, 1856; re-issued July 22, 1856.

Claim.—"The combination of rake with spring, guard, plate, and fork."

9. For an *Improvement in Operating Valves in Direct Acting Steam Engines;* Wm. H. Guild and William F. Garrison, Brooklyn, New York; patented March 27, 1855; re-issued July 29, 1856.

Claim—"Giving to the valve the whole or part of the movement necessary to effect the change in the direction of the movement of the engine piston, by means of the steam acting upon a piston which is fitted to work perpendicularly to the valve in a cylinder, forming a part of the valve driver, or device employed to drive the valve, and is supported against the pressure of steam by a rocker, by which it is caused to operate on the valve driver."

DESIGNS FOR JULY, 1856.

1. For *the Base of Clock-case Fronts;* Nicholas Muller, City of New York; dated July 1, 1856.

Claim.—"The male figure, dog, stumps, roots, leaf foliage, and blades of grass."

2. For *Clock-case Fronts;* Nicholas Muller, City of New York; dated July 1, 1856.

Claim.—"The war trophies, foliage, and eagle."

3. For *Ornamental Fire Places;* John C. Macy, Cincinnati, Ohio; dated July 8, 1856.

Claim.—"The configuration, &c., of the front plate and fender of grates.

4. For *Parlor Ovens;* Russell Wheeler and Stephen A. Baily, Utica, New York; dated July 8, 1856.

Claim.—"The general design and configuration of the stove."

5. For *Box Stove Plates;* Winslow Ames, Nashua, N. H.; dated July 15, 1856.

Claim.—"The combination, &c., of the ornamental figures and forms represented."

6. For *Cooking Stoves;* Joseph Hackett, Louisville, Ky.; dated July 29, 1856.

Claim.—"The configuration and arrangement of the ornaments."

7. For *Clock Fronts;* J. and R. Shepherd, City of New York; dated July 29, 1856.

Claim.—"The combination and arrangement of the several ornaments.

8. For *Cooking Stoves;* Benjamin Wardwell, Fall River, Mass., and Ephraim R. Barstow, Providence, R. I.; dated July 29, 1856.

Claim.—"The form, configuration of the parts or ornaments."

AUGUST 5.

1. For an *Improved Fly Trap;* Samuel Arnold, Wilson County, Tennessee.

Claim.—"The mechanical arrangement of box, jar, springs, lever, slides."

2. For an *Improved Weather Strip for Doors;* James H. Banta, Piermont, N. Y.

Claim.—"The bar constructed with the T head, and fitted into the slot in plate. Also, in combination with said bar the double inclined latch."

3. For an *Improved Reel for Fishing Rods;* John A. Bailey, Jersey City, New Jersey, Assignor to John Warren, City of New York.

Claim.—"The sliding crank, shaft, and spring, arranged so that the pinion and wheel may be placed in and out of gear as desired, and the reel connected with and disconnected from the shaft."

4. For an *Improved Mortising Machine;* Thomas R. Bailey, Lockport, New York.

Claim.—"The mandrel fitted in bearings attached to sliding plates—one of the bearings being pivoted to the plate, and the other bearings allowed to slide on the other plate; the mandrel being vibrated laterally by the screw, worm-wheel, eccentric, pitman, and bent lever."

5. For an *Improvement in Spike Machines;* Moody Belknap, Boston, Mass.

Claim.—"The improvement of making the movable knife with a rectangular recess."

6. For an *Improvement in Sewing Machines;* Sherburn C. Blodgett, Philadelphia, Pennsylvania.

Claim.—"1st, The arrangement of the crimping notch in the shuttle, for the purpose of drawing the slack thread from the needle, and thus preventing the loop of thread from being taken up a second time. 2d, The employment of a series of pawls or drivers around the circumference of a discordal or circular shuttle, whereby the driving force is applied equally, or nearly so, through a considerable arc of the circumference of such shuttle. 3d, The mode of driving the disk shuttle at its circumference, by means of a hollow pulley or sleeve, revolving around a fixed shaft or axis. 4th, The mode of giving motion to the needle arm and feed rollers, by direct connexion with the same sleeve or revolving shaft to which the drivers are attached, which drive the disk shuttle. 5th, The arrangement of the cams and lever for operating the slide, in combination with the cam and arm for operating the pressure pad."

7. For an *Improvement in Sewing Machines;* Joseph Bond, Philadelphia, Penna.

Claim.—" 1st, The driving of the spool case by placing the latter on a stationary spool case holder, within a cylindrical driver, having any convenient number of internal teeth, the driver being situated eccentrically with the holder, so that the internal teeth of the former may catch in the recesses in the edge of the spool case, and cause the same to revolve, at the same time leaving a space between the holder and the driver on the side opposite to that where the teeth act on the spool case for the play of the needle and its thread. 2d, The hooked lever, in combination with the cam on the driver."

8. For an *Improvement in Brick Press;* John Boynton, East Hartford, Conn.

Claim.—"The rotary matrices and the plate in which they are formed, hopper, filling plunger, compresses, bed or mould plate, and discharger."

9. For an *Improvement in Ice Breaking Boats;* Henry Brown and William Brown, Philadelphia, Penna.

Claim.—" The formation of a recess in the bows of a steamboat, said recess having inclined shelves and angular terminations, and angular rib, in combination with the guards, and the whole being arranged and constructed substantially in the manner set forth, for the purpose of breaking a channel through ice, and directing the broken pieces under the ice remaining on each side of the channel."

10. For *Improved Means for Attaching and Detaching to and from their Tackle;* John M. Brooke, U. S. Navy.

Claim.—" The application to boats and their hoisting and lowering apparatus, is a bolt with a hollow head opening on and forming part of a curved channel, or deflecting surface, having also a curved slot to correspond with the channel, so that a ball fitting conformably thereto, will, by the force of gravity, when permitted, follow this curve and be turned aside, and moreover will be prevented from re-attaching itself to the bolt if passing up and down before the aperture. Also, the arrangement of a cock or prop let into the side of the deflecting surface, so as to secure the ball in the head of the bolt when required, but offering no obstacle to its entrance."

11. For an *Improvement in Water Closets;* William S. Carr, City of New York.

Claim.—" The valve with its cylinder and openings constructed and acting in the seat. Also, the cup leather in the cylinder, fitted with the required amount of water leakage, when combined with said valve or cock and spring. Also, unlatching the pan from the lever to empty the contents thereof, and then retaining said pan in its depressed position while being washed out by providing the notch pin and hook, the whole constructed and acting in connexion with the gradual motion of the stern."

12. For an *Improved Envelope;* William H. Coates, Philadelphia, Penna.

Claim.—"The construction of envelopes with an extra turn down, said turn down being finished with adhesive substance."

13. For an *Improved Sash Supporter;* Charles H. Dana, West Lebanon, N. H.

Claim.—" The lever with roller on axle or pivot, arranged and operating in the inclined groove."

14. For an *Improved Printing Press;* William H. Danforth, Salem, Mass.

Claim.—"1st, The traveling bed plate and its attachments, in combination with the beds, worm shaft and crank, (or their mechanical equivalents,) and table. 2d, The improved manner that I have designed, forming the two setts of griping bars for insuring an equal gripe upon the sheets throughout their whole length, and in the manner of arranging the two sets of endless chains to which they are attached, so as to allow the two sets of griping bars to act together continuously upon the leading edge of the sheet from the time that they seize upon it until it is discharged printed from the machine, and also in the manner of insuring precision and exactness of action to the griping bars, at the time that they seize upon and relapse their hold upon the sheet, by the employment of the bar separators and brush. 3d, The movable or vibrating guide and gauge frame, constructed, arranged and operated, for the purpose of holding the ends of the curved griping bars together, while they are required to gripe the sheets, and for giving to the cross strings by means of the side lips or flanches, their required degree of tension to enable them to hold up the centre of sheets between the cross bars, while passing them across over the types, and also enable them to withdraw the prtnted sheet from off the face of the types, by not allowing the chains to be displaced from the lines that they are required to travel in by this act, and for guiding the two sets of chains and their attachments across in a line above the face of the types and pile of discharged sheets. 4th, The employment of a series of pendants suspended from movable top pieces, so that they can be moved in or out to adapt them to the various widths of sheets required to be printed, and keep them always in lines that are parallel to each other, for the purpose of uniformly guiding the discharged sheets as they fall to the pile. 5th, The device employed for giving the necessary interval of rest to the feeding chains, griping bars, &c., at the time that the impressions are to be given, consisting of the feeding pulleys, feeding wheel, ratchet wheel, pall stud, adjustable grooved disk wheel, cam, disks, pawls, pins, and brake levers. 6th, Feeding the ink supply apron between the pressure roller and the periphery of the ink fountain roller, in a manner for the purpose of insuring a graduated and an equal deposit of ink upon all parts of its surface."

15. For an *Improvement in Carpet Fastenings;* S. R. C. Denison, Rochester, N. Y.

Claim.—"My method of fastening carpets, by means of the metallic cams attached to the base board, which cams not only hold the carpet firmly in its place, but afford facilities for its instantaneous removal in case of fire or other emergency."

16. For an *Improved Metal Pavement;* Solomon B. Ellithorp, City of New York.

Claim.—" A metal block for pavements, formed of a series of groined arches, alternating in position, and connected to ridge or string pieces, with interstices between the arches to be filled with cement, gravel, or sand."

17. For *Improvements in Mechanism for Compressed Air Railroad Signals;* John W. Fowble, Cincinnati, Ohio.

Claim.—"The arrangement of the valves and lever valve with the air chest, when acted upon by the compressed air, for the purpose of setting in motion the alarming apparatus for purposes mentioned. Also, the arrangement of the levers, rods, lever, catch plates, and springs, and these arranged with the shafts and levers, for the purpose of re-setting the alarming and signal apparatus as before described when operated on by the lever valve."

18. For an *Improvement in Bagasse Furnaces;* Samuel H. Gilman, New Orleans, Louisiana.

Claim.—"The combination of a dome-covered cylindrical chamber, having a circular base, with a draft door, located at an arch-covered second square chamber, a pit, a heat conduit or throat. Also. the location in a bagasse furnace of the draft door, or opening through which the air is admitted to support combustion, at or near the hearth level or fire beds, and directly opposite the opening through which the products of combustion leave the first chamber of the furnace, and in the vertical plane passing through the centre of the two chambers, and the centre of the opening where the two chambers unite, when the hearth of the second chamber is substantially on a level with the hearth which supports the bagasse to be burned."

19. For an *Improved Wrench;* Lorenzo D. Gilman, Troy, New York.

Claim.—"The use of the adjustable jaws, moving in the slot, and operated in connexion with the groove in the jaws, forming an adjustable socket."

20. For an *Improved Instrument for Breaking Ice;* Isaac H. Griffing, City of New York.

Claim.—" The loop rod, the sliding ball or weight, and the point, all in connexion, using for that purpose any metal of any size or shape, that may be necessary for the purpose of ornament, or for obtaining the object in view, viz: breaking ice."

21. For an *Improvement in Knitting Machines;* Augustus J. and Demus Goffe, Cohoes, New York.

Claim.—"The employment of a stationary circular converging series of hooked needles, arranged in a plane, and made to slide in respect to the revolving or traveling yarn carrier and presser, and also, in regard to the stationary ring of stops, in connexion with the inside web guide."

22. For an *Improvement in Straw Cutters;* J. H. Gooch, Oxford, N. C.

Claim—" Providing a support on the axle, and having the axle, stationary, and the knife revolve on the same."

23. For *Improved Blanks for Bank Notes, Bills, &c.;* Peter Hannay, Washington, D. C.

Claim.—"The combination of the arts of photography and printing or writing, or both."

24. For an *Improvement in Means for Guiding Line Ferry Boats or Flying Bridges;* Wm. A. Jordan, Thibodeaux, Louisiana.

Claim.—"The vibratory lever, constructed, and arranged, and operated with a cable."

25. For an *Improvement in Corn and Cob Mills;* Jacob O. Joyce, Cincinnati, Ohio; ante-dated, Feb. 5th, 1856.

Claim.—"The arrangement of the segments on the upper cone, and the segment on the lower cone, so that the former shall pass through between the latter, gradually contracting the spaces between their crushing surfaces."

26. For an *Improvement in Locks;* Joseph M. Lippincott, Pittsburgh, Penna.

Claim.—"The use of a stationary tumbler chamber, with movable wards and tumblers, in combination with the fence. Also, the use of an aperture in the tumblers, into which the grooves for the passage of the fence open, but distinct therefrom, for the purpose of allowing the tumblers to resume a position in which the grooves are out of range while the fence is yet engaged in the tumblers."

27. For an *Improved Pen-Holder;* T. Kenton Lyon, Richmond, Virginia.

Claim.—"The guard attached to or made part of the holder, forming a deep annular space around the pen or that part of the holder where the pen joins it."

28. For an *Improvement in Lightning Rods;* David Munson, Indianapolis, Ind.

Claim.—"Constructing a tubular lightning rod with spiral flanches, one of which is left open or divided its entire length, for the purpose of admitting the electric current to the inner surface of the rod, to diminish its intensity and mechanical effect."

29. For an *Improvement in Rotary Knitting Machines;* S. W. Park and Edgar S. Ells, Troy, New York.

Claim.—"Combining together two annular series of hooked needles with a sinker, two pressers and an ived guide. Also, the manner of arranging two annular sets of needles in relation to each other, that is, arranging them together, so that the hooked ends of the needles of one set, are parallel or nearly parallel with, alongside of and pointed in the opposite direction to those of the other series. Also, the improvement of arranging the sinker to increase the distance between the yarn and the old loops of the second set of needles just before the barbs of these needles are pressed. Also, the improvement of arranging the cam so as to spring out the ends of the second set of needles. Also, the improvement of holding the needles of an annular series in place on the grooved needle block, or its equivalent, by the ring."

30. For an *Improved Door Stay;* Anson H. Platt, Yellow Springs, Ohio.

Claim.—"The use of the bolt, the lever, and the dog."

31. For an *Improvement in Heating Feed-water Apparatus for Steam Boilers;* John R. Sees, City of New York.

Claim.—"The heating pipes and the branch pipes, and with the chamber containing the double acting check valve and the circulating pipe, all arranged below the water line of the boiler."

32. For an *Improved Combined Steam and Hot Air Cooking Stove;* John Shopland, Honesdale, Penna.

Claim.—"The arrangement of a boiler outside and independent of the oven, so as to have the hot air and steam at variable temperatures, and mix them at pleasure, or as the character of the cooking may require."

33. For an *Improved Mode of Coloring Photographic Pictures on Glass;* D. B. and H. B. Spooner, Springfield, Mass.

Claim.—"The application of gum arabic or other equivalent material."

34. For an *Improvement in Breech Loading Fire Arms;* Gilbert Smith, Buttermilk Falls, New York.

Claim.—"Producing a flexible lip from the solid metal of the rear of the chamber, to operate as and for the purpose set forth, by forming a groove round the chamber at a short distance from the extreme rear thereof."

35. For an *Improvement in Hemp Brakes;* Meriwether Thompson, Jr., St. Josephs, Missouri.

Claim.—"The arrangement of the cone, pulleys or equivalent mechanism for varying the speed, and the arrangement of the slotted arm, shifting pitman, in such relation to each other, that by the described connexion between them, through the shifting lever and the cord, or their equivalents, and change of speed shall effect a corresponding change in the stroke of the brake."

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36 For an *Improved Corn Sheller;* Calvin Adams, Oak Hill, New York.

Claim.—"Alternating the annular rows of rotating teeth of the shelling cylinder, with stationary toothed rings, when the said shelling cylinder is combined with a rack, composed of a series of self-adjusting toothed segments."

37. For an *Improved Washing Machine;* Daniel N. Allard, Bokely, Ohio.

Claim.—"In combination with an endless apron for conveying the clothes to be washed, the series of rotating pounding balls."

38. For an *Improvement in Invalid Supporters;* James T. Alston, Raleigh, N. C.

Claim.—"Hinging the cushioned back thereof, to the central connecting cross-piece of its base frame, when the side pieces of said frame, in front of said cross-piece, are left open for the reception between them of an invalid to receive the benefit of the back and arms of said supporter. Also, connecting the arms to the base frame of the supporter, in such a manner that either of said arms can be readily detached from said frame and be confined therewith again, when the said base frame is left open in front, and is combined with the back of the supporter. Also, combining the recessed flaps with the arms of my improved invalid's supporter, when the said arms are arranged in conjunction with the base frame, and the back of the supporter."

39. For an *Improvement in the Production of Oil from Cannel Coal;* Luther and William Atwood, Waltham, Massachusetts.

Claim.—"An improved oil, obtained by the processes from natural bodies, which, alone or when mixed, afford parafine indestructive distillation."

40. For an *Improvement in Preparing Oil from Bitumens;* Luther and William Atwood, Waltham, Massachusetts.

Claim.—"The manufacture and use of the oil from bitumens, which do not yield parafine by distillation."

41. For an *Improvement in Mowing Machines;* Ephraim Ball, Canton, Ohio.

Claim.—"The lock fastening for such cutter bar, made by the removed and upset portions of the brace, and the extremity of the cutter bar."

42. For an *Improvement in Odometers;* Smith Beers, Naugatuck, Connecticut.

Claim.—"The flexible connecting shaft, composed essentially of a chain and spiral spring, or their equivalents, arranged and operating."

43. For an *Improvement in Steering Apparatus;* John W. Drummond, Norwalk, Connecticut.

Claim.—"Arranging a pinion having two leaves or wrists in such a manner, relatively with the sector or wheel acting on the rudder, that the said wrists or leaves can be turned into the plane of motion of said sector or wheel, to prevent motion to the steering wheel by any surge or wave against the rudder. Also, in combination with the aforesaid two-wristed or leaved pinion, the headed rod and spring, or their equivalents, to tend always to bring the said two wrists or leaves into the plane of motion of the sector or wheel."

44. For an *Improvement in Accordeons;* Anthony Faas, Philadelphia, Pennsylvania.

Claim.—"The sliding perforated board, when the said board is combined with the perforated board in such a manner as to produce the effects. Also, the double keys."

45. For an *Improvement in Dies for Screw Blanks;* Charles R. Gardner, Detroit, Michigan.

Claim.—"The elevation and the slope each."

46. For an *Improvement in Manufacture of Sheet Metal Ware;* Theo. Gomme and Charles E. A. Beaugrand, Paris, France.

Claim.—"The use of the rod, sliding within the stamping puncheon, for giving motion to the plate on the upper part of said puncheon, so as to hold the work in place, and subsequently to disengage it: the whole operating for preserving the thickness of the metal uniform when acted upon by the puncheon, between the grooved and beveled rings."

47. For an *Improved Fruit Box;* Jabez W. Hayes, Newark, New Jersey.

Claim.—"The combination of the two pieces of veneering, with the notches or slots, and the longitudinal openings interwoven at the centre, bent at right angles, and secured together by the cord in the slots."

48. For an *Improvement in Fire Arms;* Frederick W. Hoffman, City of New York.

Claim.—"So combining the cap with the cock, that the opening and closing of the end of the barrel shall be effected by the act of cocking the piece."

49. For an *Improvement in Filtering Sand for Cider;* Ira Holmes, Leicester, N. Y.

Claim.—"The discovery and process for making a beverage and syrup from the juice of apples."

50. For an *Improved Method of Raising, Lowering, and Operating Farm Gates;* Chester Hunter and N. Isham, Norwalk, Ohio.

Claim.—"The bars, spring, groove, and clasps."

51. For an *Improvement in Coal Hods;* Cyrus F. Kneeland, Buffalo, New York.

Claim.—"A coal hod, with a wood and metal bottom, made and secured in its place."

52. For an *Improvement in Vehicle for Paint Compounds;* Frederick Kulhmann, Lille, France.

Claim.—"The admixture of silicate of alkaline substance with a paint, varnish, ink, or dye, (instead of using it in layers or coatings, as heretofore done,) using for the protection of the several individual coloring matters, such agents as are known to scientific or practical chemists."

53. For an *Improvement in Felting Hat Bodies;* E. R. Barnes, Brookfield, and James B. Blakslee, Newton, Connecticut.

Claim.—"The peculiar arrangement of suspending and rendering elastic and adjustable, the endless rotating bed of felting machines, so that it may be elevated or depressed while in operation, and at the same time possesses an oscillating motion in order to adapt itself to the varying stages of the process of felting."

54. For an *Improved Nail Plate Feeding Apparatus;* Adolphus Heddaeus, Pittsburgh, Pennsylvania.

Claim.—"1st, Connecting the feeding apparatus with the nail machine, by ball wrists or universal joints, in some point or points, situated in a vertical line through the centre of the nail when cut, and in locating all the points of such connexion in this vertical line for the purpose of giving the feed apparatus a lateral motion in the arc of a circle, whose cutter is in that vertical line, whereby the feed apparatus may be accurately adjusted without stopping the operation either of the feeder or nail machine. 2d, The use of an elliptical spring or steel hoop, as the bearing for the front end of the feed screw, in combination with the sleeve, ball, cam, and spring, for the purpose of allowing the turning of the nail plate, and drawing it back while turning. 3d, The use of the large wheel, in combination with the pawl and pinion, for the purpose of communicating the requisite motion to the feed screw and nail plate, together with the cam wrench to lower the spring of the pawl, whereby the feed apparatus may be instantaneously stopped, without interfering with the action of the nail machine, or detaching the one from the other."

55. For *Improved Fire Arms;* Frederick D. Newbury, Assignor to Richard V. Dewitt, Albany, New York.

Claim.—"The releasing spring to throw the arm promptly down to permit a recharge of the piece. Also, the concave breech seat, or its substitute. Also, the method of arranging the tape priming by inserting the same through the stock, either with or without metal tubing. Also, the spring, when applied to the stock, to prevent the retraction of the tape, and to cover the priming from the weather. Also, the feeding spring piece, in combination with the lever as its moving power."

56. For an *Improvement in Fire Arms;* Abner N. Newton, Richmond, Indiana.

Claim.—"Two or more expanding bands, in combination with the chamber and sliding breech pin, completely overlapping the joint between said breech pin and chamber."

57. For an *Improved Sash Fastener;* Wm. Patton, Towanda, Pennsylvania.

Claim.—"The supporting and self-locking sash fastener, composed essentially of the plate, bolt, and catch, when said bolt is arranged in an upright position, and hung forward of its fulcra, so that its whole weight shall tend to throw it into the catches."

58. For an *Improved Gold Washer and Amalgamator;* Warren S. Pierce, North Attleborough, Massachusetts.

Claim.—"Constructing the washer or separator, having the furnace placed within the case, which has oblique or taper sides, the ledges or plates placed on the top plate of the furnace, and the screen, and the sponge which is fitted between the screens placed in the case."

59. For *Improved Files;* George M. Ramsay, City of New York.

Claim.—"Constructing flat files in pairs, or with right and left cutting edges or corners. Also, in making the grooves to run, in combination with said files."

60. For an *Improvement in Artificial Stone;* St. Julien Ravenel, Charleston, S. C.

Claim.—"The substitute for stone, marble, or brick."

61. For an *Improved Mode of Attaching Ink Stands to Desks;* L. R. Satterlee, Rochester, New York.

Claim.—"Attaching ink stands to desks or tables, by means of the base plate, cap, and screws."

62. For *Improved Spring Pulleys for Window Sashes;* John Shopland, Honesdale, Pennsylvania.

Claim.—"In combination with the pulley and spring, the self-acting compensating brake for holding the pulley at any fixed point regardless of the increased power of the coiled spring, as it is wound up in drawing down or raising a sash, door, or other thing to which it may be attached."

63. For an *Improved Machine for Throwing Projectiles;* A. B. Smith and William Weaver, Clinton, Pennsylvania.

Claim.—"The conformation of the ring, which encloses the revolving disk with a movable muzzle. Also, the spiral tube, for gradually communicating the motion of the disk to the balls when its outer end is turned radially (or thereabout) outward, and is provided with a valve in said radial portion. Also, the mode of opening the valve, whereby the balls are invariably brought to the ring at a given point, and that point changeable at pleasure, irrespective of the position of the ring relative to the disk, or of the point to which it may chance to be directed. Also, the employment of the cam."

64. For an *Improvement in Manufacturing Chairs;* Edward Q. Smith, Cincinnati, O.

Claim.—"The arrangement of the sliding table, in combination with the cutter head and cutters, furnished with the adjusting piece for holding the pillar to its proper relative position to the cutter head, or equivalent means for making the top of the pillar the desired form and size to fit the dovetail in the chair back."

65. For an *Improvement in Treating India Rubber;* Wm. F. Shaw, Boston, Mass.

Claim.—"The treatment of sulphured rubber, or gutta percha, with unsulphured drying oils, or unsulphured rubber, or percha, with sulphured drying oils."

66. For an *Improved Method of Lettering and Ornamenting Glass;* Jerome B. Shaw, Pittsburgh, Pennsylvania.

Claim.—"The employment of patterns of metallic foil, and cementing the same to and removing them from the glass, whereby I am enabled to produce ornamental designs on glass at a greatly reduced cost."

67. For an *Improvement in Corn Harvesters;* Andrew Sprague, Coldwater, Michigan.

Claim.—"The guard, in combination with the knives."

68. For an *Improvement in the Manufacture of Hat Bodies;* Alva B. Taylor, Newark, New Jersey.

Claim.—"Regulating the distribution of the fur or other stock, upon the perforated cone, by varying the feed to the picking cylinder at different parts of its length."

69. For an *Improved Mode of Extracting Stumps;* Wm. O. Thompson, Orange, and Leonard Harrington, Worcester, Massachusetts.

Claim.—"The combination and arrangement of the lever and gallows frame, in connexion with the pulleys or power applied."

70. For an *Improvement in Planing Metal;* Chester Van Horn, Springfield, Mass.

Claim.—"Supporting the cross slide by means of the uprights, with the beam fitted between them at one side of the bed plate and framing, and having either one upright or two at the opposite side of the bed plate and framing."

71. For an *Improvement in Spinning Frames;* Thomas W. Taylor, Cannelton, Ind.

Claim.—"The construction, arrangement, and driving of the flyers of fly-frames, in combination with either a live or dead bobbin spindle, as the case may be."

72. For an *Improvement in Valve Gear for Steam Hammers;* Charles W. and John P. Willard, Dorchester, Massachusetts.

Claim.—"The combination of the bent rocker lever, the actuator, and the two adjustable cams, the whole being applied together, and to the valve rod and trip hammer."

73. For an *Improved Rock Drill;* George H. Wood, Green Bay, Wisconsin.

Claim.—"The combination of the hooked pitman, crank, and strap, as a mechanism for lifting the drill."

74. For an *Improvement in Blast Furnace;* Wm. Wright and George Brown, Newcastle, England.

Claim.—"The general arrangement and construction of cupolas and smelting furnaces for the self-heating of the air blast, by the arrangement of the chambers and air passages."

75. For an *Improvement in Processes of Separating Silver from Tin Ore;* Wilhelm Beirvogel Trescow, Pennsylvania.

Claim.—"The application of water or a solution of sulphate of copper, slightly impregnated with sulphuric acid, instead of lead, quicksilver, or salt, hitherto used for this purpose, to the process of separating silver from copper, and other ores, rendering thereby this separation easier, shorter, less expensive, and not noxious to the health of the operator."

76. For an *Improved Machine for Wringing Clothes;* Robert P. Bradley, Cuyahoga Falls, Ohio, Assignor to Joel Wisner, East Aurora, New York.

Claim.—"The construction and arrangement of the springs, so as to compensate for shortening in the act of wringing, at the same time form posts at the sides for bearings."

77. For an *Improved Chimney Cowl;* George W. Thatcher, Philadelphia, Penna.

Claim.—"The introduction of one or more central tubes, with their caps or frustrums enclosed within an outer tube with its cap or frustrum, and extending downwards within the outer tube, so as to increase the upward draft and afford protection from winds and storms."

78. For an *Improved Ore Washer;* Hezekiah Bradford, Assignor to Horatio Bogert, City of New York.

Claim.—"The employment of a hollow perforated cylinder, rotating on a horizontal, or nearly horizontal axis, provided with numerous pins or teeth on the periphery pointing towards the axis, combined with a feeding aperture and hopper at one end, and lifting scoops and delivery aperture at the other end; and with a water trough or vessel, within which the lower part of the said cylinder revolves, the said trough or vessel being provided with a delivery aperture controlled by a valve."

79. For an *Improvement in Refrigerators;* Thaddeus Fairbanks, Assignor to John C. Schooley, St. Johnsbury, Vermont.

Claim.—"Combining an ice receptacle with the interior of a refrigerator, as that a continuous circulation of air shall be kept up through the ice in said receptacle, and through the interior of the refrigerator, and so that the circulating air shall deposit its moisture on the ice every time it passes through it, and be dried and cooled, passed through the interior of the refrigerator."

80. For an *Improvement in Brick Machines;* Isaac Harman, Assignor to self, and William Bickel, Tamaqua, Pennsylvania.

Claim.—"The moulds, composed of the two halves having any convenient number of angular projections and recesses, the points of the angular projections of one-half coinciding with those of the other half, the said moulds being caused to expand and contract."

81. For an *Improvement in Vapor Burning Lamps;* Samuel Whitmarsh, Northampton, Massachusetts, Assignor to Wm. J. Demerest, Orange, New Jersey.

Claim.—"The method of heating the air, supplied through the air holes in the outer cylinder, in the space between the cylinders."

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82. For an *Improved Mould for Pressing Glass Fountain Lamps;* Henry W. Adams, City of New York.

Claim.—"The mould."

83. For an *Improvement in Lime Kilns;* Levi Avorill, Elmira, New York.

Claim.—"The construction and arrangement of the kiln with small separate branches, situated outside or around a single furnace, from which the heat is conducted through conveying passages to several points of their peripheries."

84. For an *Improvement in Furniture Polish;* John L. Brabyn, City of New York.

Claim.—"The combination of muriatic and acetic acid, with the usual ingredients of furniture polish, in the proportions and manner specified, for the purpose of producing a polish capable of resisting the action of hot or cold water."

85. For an *Improved Blastic Compound;* Lewis Buchholtz, Richmond, Virginia.

Claim.—"The composition and application of the above mentioned ingredients, whether in the ratio described, or any other substantially the same."

86. For an *Improvement in Coupling Pipes;* George Fetter, Philadelphia, Penna., and John S. McClintock, Libertyville, Illinois.

Claim.—"A new and improved mode of attaching connexions to lead pipes, the tapering screw terminating in a smooth and rounded end on the connexions for the purpose of guiding the said screw, and preventing the lead from burring up inside the pipe, in combination with a tapering ferrule on the end of the lead pipe, said ferrule having any convenient number of projections for preventing the pipe from turning within the ferrule while the end of the said connexion is being secured into the pipe."

87. For an *Improved Farm Fence for Rolling Ground;* Ephraim D. Foss, Mainville, Ohio.

Claim.—"The vertical shifting base post, in combination with the arrangement and use of the tenons."

88. For an *Improvement in Knife Cleaners;* William W. Hopkins, Chesterfield Factory, Massachusetts.

Claim.—"The reciprocating scourers and elastic bolster."

89. For an *Improvement in Felting Compounds;* Lansing E. Hopkins, Brooklyn, New York.

Claim.—"Keeping the articles to be felted constantly saturated with, or immersed in a solution of saponaceous matter during the operation of felting, and near the close of the operation, adding to said solution a small quantity or ammoniacal matter."

90. For an *Improvement in Paddle Wheels;* Abraham Houseworth, City of N. York.

Claim.—"The floats or buckets applied or attached to the wheel as shown, and expanded or spread, and contracted or closed by the cams."

91. For an *Improvement in Machines for Adding Numbers;* Isaac G. Hubbs, City of New York.

Claim.—"The disk with its continuous spiral tooth, the racked index and the indicator."

92. For an *Improved Machine for Sweeping Gutters;* Wm. H. King, Assignor to self and Isaac Hyneman, Philadelphia, Pennsylvania.

Claim.—"The combination of the skewed revolving brush and guiding board, for the purpose of making a side or gutter sweeping machine, that will leave the sweeping in the winrows."

93. For an *Improvement in Thorough Braces for Carriages;* Frederick A. Jewett, Abington, Massachusetts.

Claim.—"Combining with a thorough brace a right and left threaded screw, working in nuts, whereby the thorough brace can be tightened, and the slack taken up at the same time."

94. For an *Improvement in Cupping Instruments;* Sherman McLean, Reynalis Basin, New York.

Claim.—"Constructing the cup with one or more smaller cups fitted and secured within it, and provided with perforated sides."

95. For an *Improvement in Harvesting Machines;* Larkin L. Moore, Petersburg, Va.

Claim.—"Adjusting the frame on its supporting wheels for cutting higher or lower, by uniting the frame and tongue by means of the pivoted hounds, screw-winch, and pin passing through a slot in the rear of the tongue into the standard."

96. For an *Improvement in Machines for Pressing Bonnets and Bonnet Frames;* Wm. Osborn, Louisville, Kentucky.

Claim.—"Forming the flaring face piece and side crown of a bonnet or bonnet frame in one piece and at one operation, and irrespective of the particular form of the bonnet or frame."

97. For an *Improved Machine for Forging Horse Shoe Nails;* Charles Parkhurst and Charles Weed, Boston, Mass.

Claim.—"1st. Making the nail guide movable up and down with respect to the anvil, and its top and lateral hammers, when said anvil is made stationary as specified, said improvement being advantageous in several respects. 2d, The combination of mechanism for operating said nail guide, or removing it from the anvil to the cutters, and retaining it between the cutters during the descent of the vertical slider far enough to separate the nail from the rod, said combination consisting of the lever latches, the eccentric, the rocker lever, and the springs applied to the guide, and the vertical slider."

98. For an *Improved Tenoning Machine;* John Potter, Ellicottsville, New York.

Claim.—"1st, The combination of the revolving knife, cutter heads, and rotating saws, when these devices are arranged in relation to each other, and for operation together, causing the knives of the cutter heads to relieve the saws from binding, and ensuring many other advantages in the cutting of the tenon as specified. 2d, The alternate arrangement on the cutter heads, when operating in relation to and connexion with the saws of the square and level nosed knives or cutters for action with each other, and the saws in the formation of the shoulder."

99. For an *Improved Bristle Separator;* Adonijah Randel, City of New York.

Claim.—"The vibrating board and discharging rollers."

100. For an *Improved Hand Stamp;* Edwin A. Russell, Hookset, N. H.

Claim.—"Combining with the movable lever or stamp carrier and beds, whereby during, and by the lateral movements of the said lever or stamp carrier from one bed to the other, the stamp shall not only be struck or forced downwards, but raised off the same, such mechanism be a trip hammer with its operating spring, a cam, and a spring, constructed and made to act with respect to the stamp and its carrier."

101. For an *Improvement in Cart Saddles;* Henry A. Rains, Nashville, Tennessee.

Claim.—"Uniting the tree bars and pads of a saddle, by providing said bars with grooves around their edges, or with grooved rims or the linings of the pads with looped, corded or perforated borders, which are firmly but removably secured in the grooved edges of the tree bars, by wires, cords, or bands, passing through or around said loops or borders, and held by right hand and left hand screws, or equivalent fastenings."

102. For an *Improvement in Valve Motions for Steam Engines;* Edward S. Renwick, City of New York.

Claim.—"1st, The combination of the parts of a valve motion, so that the steam valves shall be opened by mechanism at intervals coincident, or thereabouts, with the opening of the exhaust valves, and that the steam valves shall be closed by mechanism, that is, independent of the exhaust valves, but which governs and controls the toes, by which the steam valves do not change the angular position in which these toes have been placed to open the valves. 2d, The combination of the steam toes, rock shaft, arms and link, with the exhaust rock shaft for opening the steam valves. 3d, The combination of a cam, and spring cam box, with mechanism for imparting the movement of the cam box to the valves. 4th, The combination of the yokes and shaft, with appropriate operating mechanism depending upon the movement of the crank shaft of the engine, for holding the steam toes in the proper position to open the valves and for lowering the same bodily to close the steam valves. 5th, Closing steam valves that have been opened by moving the steam toes, or their equivalents, bodily, without changing their angular position the distance required to shut the valves."

103. For an *Improvement in Projectiles;* Nathan Scholfield, Norwich, Conn.

Claim.—"1st, The application of wings, either with slight springs to force them from close contact with their seats when left free, so as to allow the air to act thereon to perfect their expansion, or by having a free passage for air beneath the wings, and giving them a slight inclination diagonally on the cylindric surface and without springs. 2d, The construction of the guiding wings for a projectile to be fired from a gun of thin sheets of metal, having one of their edges folded around a piece of wire, or its equivalent, to form journals on which the wing may turn as joints. 3d, Applying these wings, either plane or curved, on the cylindric surface of a projectile, and either parallel to its axis, or diagonally in such form and position that the said wings may be closed down on the cylindric surface, or on grooves thereon fitted to receive them, and by the action mainly on the air on the wings as the projectile is discharged, they shall be opened and expanded, as above described. 4th, The construction and application of these wings slightly curved, composed of metal possessing sufficient elasticity to resume their curved form after being changed therefrom, so that if while its rear end rests on its seat, the forward end of the wing is elevated therefrom when free, then, if this end is also pressed down to its seat, it shall be raised again by its elasticity when left free from pressure, so that the action of the air on the exposed curve of the wings will force them open to their greatest capacity after being discharged from a gun."

104. For *Improved Bedsteads;* John H. Belter, City of New York.

Claim.—"1st, A bedstead constructed of thin parts, supported independently without posts or joints, when the parts are composed of veneers. 2d, The wedge-shaped projections on the inside face of each part of the shallow notches on the edge of the internal frame."

105. For an *Improvement in Concentration of Milk;* Gail Borden, Jr., Brooklyn, New York.

Claim.—"Producing concentrated sweet milk by evaporation in vacuo, the same having no sugar or other foreign matter mixed with it."

106. For an *Improvement in Wheels for Carriages;* Thomas Brownfield, Georges Township, Penna.

Claim.—"The rim of the hub which is made in sections, which being constructed in this manner will press on all the spokes, and hold them all firm in the hub, and the iron plate which covers these sections, which will bend and let the sections fit the spokes with the pressure of the screws, and hold the sections in their places, and the nuts on the spokes which hold the felloes and tire to their proper places."

107. For an *Improved Door Spring;* John Broughton, Chicago, Illinois.

Claim.—"The employment of an additional hinge unfolding and folding the reverse of the hinges, and having formed on each of its leaves, a quadrantal or other suitable projection, in combination with the flat or other suitable springs."

108. For *Improved Carpenters' Gauges;* Joel Bryant, Brooklyn, New York.

Claim.—"The invention, construction, and exclusive right and use of point holders, or holders for the points, markers, and cutters of gauges, irrespective of the kind or form of gauges, or instruments equivalent thereto."

109. For an *Improved Sash Supporter;* Charles S. Bruff, Baltimore, Md.

Claim.—"The application of the rack, corrugated in the particular form described to one edge of a sash, and the metal spring catching into said corrugations secured in the jambs, or on the stop bead, for the purpose of holding up window sashes at any desired elevation."

110. For an *Improvement in Clamping and Upsetting Tire;* Oscar L. Coubes, Tecousha Township, and Allan L. Denning, Homer Township, Mich.

Claim.—"The combination of the lever with the auxiliary clamping levers, the carrying studs, the connecting bars, the saddle piece, and the slotted clamping bars, for the purpose of clamping and then upsetting tire by single continuous motion of the slotted lever."

111. For an *Improved Method of Regulating Velocity of Feed for Sawing Mills;* R. Eickemeyer, Yonkers, New York.

Claim.—"Driving or operating the log carriage by means of two shafts, placed more or less out of line with each other, and connected by a pin or grooved plate, or draw link, or any other equivalent device, for the purpose of giving a variable movement to the carriage, thereby feeding the log to the saw."

112. For an *Improved Window Sash;* Francis Sessions, Worcester, Mass.

Claim.—"The new or improved combination or manufacture of window sash, as made not only of rebated and tenoned side and cross bars, but of separate rebated corner pieces, or combinations cast in manner as specified on the tenoned ends of said bars, and not only constituting rebated annular continuations thereto, so as with said bars to complete the sash frame, but serving to connect the bars together."

113. For an *Improved Arrangement of Steam Cylinder within the Boiler;* John S. Shapter, City of New York.

Claim.—"Enclosing a steam cylinder in a steam chamber, separated from the body of the steam boiler, where the supply of steam can be shut off from the chamber by a valve for that purpose, and where the cylinder and its attachments can be got at through a man hole, when the supply of steam to the chamber is so shut off."

114. For an *Improved Washing Machine;* John S. Shepler, Beaver, Penna.

Claim.—"The forming of ribs in sections parallel to the rubbers, and gradually forming a double inclined plane out of any odd number of ribs, thus causing a wedge-shape opening between the ribs of equal opening when vertical to each other, to admit the clothes as the machine rotates back and forth, without the abrupt contact caused where the ribs are of equal height."

115. For an *Improved Head Rest to be used in Railroad Cars;* William B. Slaughter, Chicago, Illinois.

Claim.—"The yoke, together with its mode of attachment to the person, and the combination of the hand rest with the yoke, so that it can be attached to the person and made to serve the purpose of a head rest without any other attachment."

116. For an *Improvement in Harvesters;* William Tinker, Kellogsville, Ohio.

Claim.—"Forming the cutting teeth with narrow back projections, having cutting edges parallel to each other along the sides of each projection so as to cut at right angles to the face of the finger bar, when said projections are arranged for operation over the fingers between the finger bar and sickle, in combination with the wiper wheel, driving appliance for giving an abrupt action to said cutters, for the better clearance from grain or grass of the space which separates the finger bar and sickle."

117. For an *Improved Vice;* R. W. Thickens, Brasher Iron Works, New York.

Claim.—"The combination of the levers or bars, and slotted arm, arranged and applied to the jaws."

118. For an *Improved Self-Clearing Chimney Cowl;* Charles H. Watkins, City of New York.

Claim.—"One or more legs, having the circle of the revolving top, and connected with a common spindle."

119. For an *Improvement in Water Proofing Textile Fabrics;* Benjamin Weigert, City of New York.

Claim.—"The treatment of textile fabrics with a solution of acetate of alumina and glue."

120. For an *Improved Grapple for Raising Sunken Bodies;* Greenleaf A. Wilburn, Skowhegan, Maine.

Claim.—"The improved construction of the grapple to be operated with a buoy and staple."

121. For an *Improved Apparatus for Boring Artesian Wells;* Clarendon Williams, Franklin, Missouri.

Claim.—"The boring of earth and stone, and sinking of tubing at one operation, forming artesian wells by the mechanism employed, consisting of screw and nut."

122. For an *Improved Machine for Swaging Iron;* John T. Willmarth, Worcester, Massachusetts.

Claim.—"Mounting the hammers on opposite sides of a rocking frame, operated by eccentrics, or their equivalents, in combination with the anvils placed on opposite sides of the axis of vibration of the said rocking frames."

123. For an *Improvement in Locks;* Hjalmar Wynblad, City of New York.

Claim.—"The arrangement of a series of eccentric disks, separated by stationary ward plates, with each of said disks having an orifice at the centre of its motion, fitted to the shape of the bits of the key, and moving upon and guided by a segmental standard, and moved at the same time and to the same distance within a frame, and attached to and working the bolt of a lock."

124. For an *Improvement in Frames for Bleaching Ivory;* A. C. Breckenridge, Assignor to Julius Pratt & Co., Meriden, Conn.

Claim.—"Providing the bleaching frame with grooved strips of glass, to receive the ends or sides of the pieces of ivory, in such a manner as to retain the said pieces in the frame while it is turned over, and to leave every portion of the upper surface of the ivory exposed to the sun's rays, whichever side of the frame is upward."

125. For an *Improvement in Machines for Drilling and Dressing Stone;* William M. Barton, Assignor to self and Robert M. Barton, Russellville, Tennessee.

Claim.—"The arrangement of the drill on one side of the slab or stock, and the crank and connecting rod on the other, with the spring and vibrating arm, to connect the said drill and connecting rod."

126. For a *Musquito Canopy;* Levi J. Henry, Assignor to Benjamin J. Hart, City of New York.

Claim.—"1st, The construction of the clamp with the rod and screw studs, by which the canopy frame may always be made to stand vertically whether the clamp itself stand vertically or horizontally. 2d, The cap fitted to receive the bars for sustaining the canopy or covering, when combined with the sliding tubes for regulating the height of said canopy, and also receiving the bars when transported."

127. For an *Improved Wheelwrights' Machine;* A. D. Stowell, Assignor to John A. Place, Fulton, New York.

Claim.—"The combination of the spoke set with the carriage carrying the hollow auger, when the whole is attached to the hub while resting over the pit."

128. For an *Improvement in the Process of Preparing Linseed, &c., for Pressing, in Extracting Oils;* Charles Moore, Trenton, New Jersey.

Claim,—"Forming it or them into cakes, by moulding and partially pressing or packing it or them."

129. For an *Improvement in Rock Drills;* Wm. M. Barton, Assignor to self and Robt. M. Barton, Russellville, Tennessee.

Claim.—"The combination of the segmentally toothed wheel gearing into the ratchet wheel, with the spring and its drum."

130. For an *Improvement in Magneto-Electric Machines;* Edward Shepard, City of New York.

Claim.—"The springs, the flattener plates, the connecting rods, and the conducting bands or rings, when these are combined with helices in sets of four; said helices being united amongst themselves and by their terminal wires, with the rings or their mechanical equivalents, so as to collect and aggregate in one current the several currents generated in the said helices when revolved between the magnetic poles."

AUGUST 26.

131. For an *Improved Method of Applying one Stream of Water to assist in Raising another;* Charles J. P. Ariail, Roxbury, Connecticut.

Claim.—"The arrangement for raising water of two concentric annular channels, to which are fitted self-acting rotating valves, attaching to one channel a siphon, through the suction of which and pressure of water following, the rotating valves are operated."

132. For an *Improvement in Apparatus for Evaporating Salt;* William T. Clough, Newark, New Jersey.

Claim.—"The apron, chamber, and escape flues, arranged and combined with the pan."

133. For an *Improved Wind-Mill;* William C. Chambers and Thomas S. Hargraves, Brooklyn, New York.

Claim.—"1st, Attaching the plate which supports the wheel to the rudder plate, in such a manner as to allow it a vibrating rotary motion, whereby the mill is rendered self-regulating. 2d, The combination and arrangement of the segment gear, pinion, drum, and weights (or any equivalent mechanism), for holding and retaining the wind wheel always in a proper position."

134. For an *Improved Instrument for Laying Out Rafters;* Legrand Crofoot, Syracuse, New York.

Claim.—"The combination of the adjustable expanding measure, with the adjustable levels. Also, in combination with the above, the fixed square plates sliding on the levels."

135. For an *Improvement in Hay Rakes;* Charles P. Carpenter, St. Johnsbury, Vt.

Claim.—"The slotted bed plank, the movable head, the guide rods, the catch, and the connecting of the tugs to the brackets, by the links, or their equivalent device or devices."

136. For an *Improved Instrument for Measuring Distances from a Single Station;* Enoch A. Crandall, Friendship, New York.

Claim.—"The combination of the stationary telescope, the movable telescope, with its index bar and index, and the multiplying levers, with their indexes and springs, and by their respective scales."

137. For *Apple Parers;* Charles P. Carter, Ware, Massachusetts.

Claim.—"The disk, with its cover, and slicking knife, operating, viz: the purpose of the said disk being to regulate the motion of the apple by pressure of the hand, without the necessity of any other screw."

138. For an *Improvement in Condensers for Steam Engines;* John T. Denniston, Lyons, New York

Claim.—"1st, Forming a partial vacuum before the commencement of the eduction of the steam from the engine to the condenser, by first filling the condenser with water, and then partially withdrawing the water to form steam space. 2d, Suspending the water in the condenser in a number of cups or cells, with perforated bottoms and passages between them, thus causing the steam to circulate among, and over, and under the water in the cups, and through the shower of water falling through the condenser."

139. For an *Improved Self-adjusting Fog Bell;* Henry L. De Zeng, Geneva, N. Y.

Claim.—"1st, Attaching a float to a lever or arm, that is connected at or near the other end, to a fixed vertical shaft or axis, in such a manner that said float shall be allowed to swing around said vertical shaft or axis, and accommodate itself to the direction in which the swell or current or both are moving, so that said float is not subjected to any sideways concussion or strain from either the tide or swell, but is free to oscillate or vibrate with the swell, and communicate motion to any suitable bell or other alarm. 2d, Attaching the ends of a chain, or its equivalent, on opposite sides of a lever that receives a vibrating or oscillating motion from a swell, when said chain is passed over a cam-wheel, or other similar article, to communicate the motion imparted to the lever and chain, to the hammer of a bell or other signal of alarm. 3d, The arrangement of the cam and catch, relatively with the heel of the hammer, and with the chain, whereby the vibrating motion of the chain works the said hammers."

140. For an *Improved Cultivator;* Henry D. Gause, Freehold, New Jersey.

Claim.—"So constructing and arranging my cultivator, by means of the clevies, the beams, and brace, that in combination with the seat, the ploughs may be guided by the feet of the driver."

141. For an *Improvement in Manufacturing Seamless Hosiery;* Wm. Goddard, City of New York.

Claim.—"The process or method of manufacturing seamless hosiery of the form required for what is known as seamless tubular knitted fabrics, such as are knitted on machines, that knit the tubes of a uniform diameter, and adding thereto the ribbed top, the heel, and the toe, by hand knitting, or any equivalent therefor."

142. For an *Improvement in Seed Planters;* J. Herva Jones, Rockton, Illinois.

Claim.—"The use of a hinge or joint, or its equivalent, for connecting two single hand planters at their tops, for the purpose of allowing them, like a pair of compasses, to expand and contract in their operation."

143. For an *Improved Ball Caster for Trunks and Furniture;* Judson Knight, Newark, New Jersey.

Claim.—"The combination of the points, and the ball working in an open socket."

144. For an *Improved Bedstead;* Elias Howe, Jr., Brooklyn, New York.

Claim.—"A spring-bed constructed of a series of springs which over-lie each other, are combined together and arranged in an inclined position upon a bed bottom."

145. For an *Improvement in Air-Heating Furnaces;* John Liddle, City of N. York.

Claim.—"1st, The construction of the main body of the furnace, forming by plates attached to the internal surface, a series of tubes around its circumference, so as to form the smoke flues without any vertical joints between the interior and exterior, and without the employment of cores in casting. 2d, Also, making the lower section of the radiator, with the sides forming an acute angle, and in combination with the legs."

146. For an *Automatic Attachment to Gas Burners;* A. R. Marshall, Stratford, Conn.

Claim.—"1st, The combination with the thermostat and the valve, of the catch on the bar, and the system of levers for the locking and unlocking of the valve. 2d, Combining with the locking catch, or its equivalent, which is acted upon by the thermostat, another catch so arranged as to lock the valve open, until the catch is set in operation by the action of the thermostat, and then to be moved out of the way by the catch."

147. For *Curtain Fixtures;* Purches Miles, Hartford, Connecticut.

Claim.—"The levers, actuated by the coiled springs."

148. For an *Improvement in Hand Corn Planters;* Cornelius Martratt, Albany, N. Y.

Claim.—"The combination of the staff collar and spade, with reservoir."

149. For an *Improvement in Water Gauges for Steam Boilers;* Lucius Paige, Cavendish, Vermont.

Claim.—"Applying the said chamber, or arranging it with respect to the gauge, so that it shall partially surround the same, and form a niche or recess to receive such gauge, and radiate heat upon it towards its axis ; the said recess being provided or not as the case may require, with the curved cover or slider made to operate therewith. Also, constructing the gauge in tubular sections of glass, or other suitable transparent material, in combination with providing the same with a clamp frame or apparatus, and connexions, rings, and caps."

150. For an *Improvement in Brick Machines;* Henry B. Ramsay, Indianapolis, Ind.

Claim.—"1st, The wheel, cranks, and catches, in combination with the springs, for the purpose of regulating the stroke of the knives for cutting the clay at the top of the moulds. 2d, The sliding mould table, for the purpose of raising the moulds to the grate under the clay box."

151. For an *Improved Amalgamator;* Alva M. Stetson, San Francisco, California.

Claim.—"The employment of the boxes placed in vertical succession, when said boxes are fitted with tubes or pipes for containing the quicksilver, and for distributing the water."

152. For an *Improvement in Making Lead Pipe;* John Robertson, Brooklyn, N. Y.

Claim.—"The construction and arrangement of the core, with the guide, in combination with the piston."

153. For *Improved Bedsteads;* Jacob J. Smith and Jonathan H. Pugh, Philadelphia, Pennsylvania.

Claim.—"Supporting the four main posts of a bedstead by screwing, or otherwise inserting them so that they shall stand securely without connexion with any rails upon the base, which rests immediately upon the floor; the said base frame being held together at its corners by means of the tenons on the said posts. Also, adjusting the said platform, or its equivalents, to any required inclination, by means of the right and left screw shaft, blocks, inclined planes, disk and plates, or their equivalents."

154. For an *Improved Fountain Pen;* Nelson B. Slayton, Madison, Indiana.

Claim.—"The fountain pencil, consisting of a tube tapering to a point, and slit from the said point some distance up two or more sides, said tube being connected with an ink reservoir, which is closed except at its connexion with said tubes, and from which the ink is caused to flow through the said tube and down the slits thereof, and issue from the point thereof, when the said point is moved in contact with a surface of suitable character to receive an inscription in ink. Also, regulating the degree of fineness of the writing or marks produced, by means of a screw thread and cone on the exterior of the tube, and a nut, carrying a conical cup fitted to the said screw thread and cone, and acting in opposition to the elasticity of the nibs of the tube."

155. For an *Improvement in Machinery for Filling Seine Needles;* Simon F. Stanton, Manchester, New Hampshire.

Claim.—"Giving the needles a vibrating motion, in combination with the arm which delivers the twine vibrated perpendicularly, and traversed horizontally, so as to deliver the twine across the score and around the tongue of the needle."

156. For an *Improvement in Bilge and Leakage Water Indicators for Ships and other Vessels;* Reuben Shaler, Madison, Connecticut.

Claim.—"The sectional diaphragm spring, as arranged in relation to the chamber and the standard."

157. For an *Improvement in Apple Parers;* Marvin Smith, New Haven, Conn.

Claim.—"1st, The construction of a machine for paring and slicing apples, in such a manner that a vibratory or oscillating motion may be given to the fork carrying the apple simultaneously with the axiel or rotating motion of the same, whereby I am enabled to use a paring knife that shall be automatic or self-acting in its operation, yet equally adapted to paring apples large or small. 2d, The knife and handle, hinged and operating in such a manner that the adjustment of the cutting edge of the knife to the entire surface of the apple, shall be coincident with the vibratory or oscillating motion of the fork carrying the apple. 3d, The pawl, or its equivalent, hinged at such a point with respect to the oscillating centre of the fork, that, as the said fork is moved in the direction of the hinge of said pawl, the point of contact between the fork and the pawls, shall recede from the oscillating centre of said fork."

158. For an *Improvement in Dynamometers;* George and John W. Gibbs, Canton, Ohio.

Claim.—"The register or pointer, which shows the average or mean draft in combination with the slot and pin, or its equivalent, which overcomes the vibrating motion of the pointer shown on the dial."

159. For an *Improvement in Cupping;* Loyall Tillotson, Thompson, Ohio.

Claim.—"The spiral wire, disk, and loop, combined and attached to a cupping instrument, for the purpose of employing electricity in conjunction with cupping as an adjuvant for diseased parts of the human body."

160. For an *Improvement in Machinery for Felting Hat Bodies;* Joseph Thomas, Brooklyn, New York.

Claim.—"The employment of a discharging slotted wheel, for feeding the goods into and through the machine."

161. For an *Improvement in Potato Diggers;* Silas Woolson, Woodna, N. Y.

Claim.—" The employment of an open concave digger, arranged and combined with a movable standard."

162. For an *Improved Implement for Milking Cows;* William H. Whitman, Bailey Hollow, Pennsylvania.

Claim.—" Placing the fingers within a case, and at the sides of holes in the case, the fingers being vibrated by means of the eccentric rollers and elastic bars."

163. For a *Grain Cleaner and Separator;* Richard Ward, Edinburgh, Indiana.

Claim.—" The combination and arrangement of the curved board, with the slide, the chaff conductor and the slide."

164. For an *Improved Method of Operating Farm Gates;* Caleb Winegar, Union Springs, New York.

Claim.—" Opening and closing gates by the means of the ratchet drum, the weight, or an eqaivalent spring to draw back the said ratchet drum through an intervention of the chains and rods. Also, my arrangement of rod and chain, connected with the spring catch for the purpose of attaching the latch."

165. For an *Improved Brace;* Daniel M. Baird, Warrensville, Assignor to Nathaniel Potter, Erie County, New York.

Claim.—" 1st, Inserting the mandrel in the chamber, in the shank of the brace; this I claim in combination with the washer, set screw, and thumb piece. 2d, The manner of attaching the head of the brace to the spindle, by means of the thumb nut, and collar; this I claim in combination with the chamber that receives the collar and screw of the thumb nut."

166. For an *Improved Device for Preventing Liquids from Boiling Over;* John Liblong, Assignor to Edward Brown and James R. Case, Waterbury, Connecticut.

Claim.—" The cap, placed within the vessel, constructed as set forth."

167. For a *Machine for Sizing Comb Blanks;* Wm. Fosket and Benjamin S. Steadman, Assignors to Julius Pratt & Co., Meriden, Connecticut.

Claim.—" The gradually receding edge, arranged within or around, and inclining towards a rebate, so as to form a tapering opening between them, with a resting place at the narrow end of the opening, when combined with a set of arms, rotating or otherwise moving over the opening, and with boxes, compartments, or other receptacles below."

168. For an *Improvement in Sewing Machines;* A. F. Johnson, Assignor to self and F. A. Houghton, Boston, Massachusetts.

Claim.—" 1st, The combination of a swinging ellipse as a shuttle thrower hung on a pivot, with a cam on the driving or other rotating shaft, so operating with said swinging ellipse, as that when the cam is bearing upon it near its pivot, it shall move the shuttle faster or through a larger space in the same time, than when it is bearing upon the other parts. 2d, The combination of the rocker-shaft and its arm, and connecting rod, with the grooved cam, operating together for giving the required motions to the feeding plate. 3d, The means employed for varying the length of the feed motion, and consequently the length of the stitch, at pleasure, the same consisting of a screw-shaft working in the hollow vertical shaft that moves the rocker-shaft, and raising or lowering a loose collar to which the connecting rod is attached."

169. For an *Improvement in Lamps;* Peter C. Guion and Paul K. Wombaugh, Cincinnati, Ohio.

Cliam.—" The elastic bulb or reservoir surrounding and communicating at bottom with a hollow stem which supports and opens into the bowl, in the described combination with the air duct, having an inwardly opening valve, affording the described means of communication from the external atmosphere, to the upper part of the bulb, or equivalent devices."

ADDITIONAL IMPROVEMENT.

1. For an *Improved Apparatus for Raising and Lowering Carriage Tops;* Anson Quigley, Sheldrake, New York ; patented April 22, 1856 ; additional, dated August 26, 1856.

Claim.—"The box, pawl or catch, in combination."

RE-ISSUES FOR AUGUST, 1856.

1. For an *Improvement in Photographic Pictures on Glass;* James A. Cutting, Boston, Mass.; patented July 11, 1854 ; re-issued August 12, 1856.

Claim.—"The combination of balsam, or its equivalent, with positive photographic pictures on glass, and with the additional glass, by which they with the balsam are hermetically sealed."

2. For an *Improvement in Apple Parers;* Charles P. Carter, Ware, Mass.; patented October 16, 1849 ; re-issued August 12, 1856.

Claim.—"1st, The combination of the spiral groove, the rack bar and sector, or their equivalents, for the purpose of moving the knife automatically. 2d, The combination of the spiral groove, the lever and the sliding bar, or their equivalents, for the purpose of throwing the apple from the prongs, after the paring is completed. 3d, Giving to the knife a slight play around its axis, independent of the mechanism which actuates it."

3. For an *Improved Machine for Making Wrought Iron Railroad Chairs;* Wm. Van Anden, Poughkeepsie, New York, Assignor (through others) to Alexr. Frear and Jacob Rowe, City of New York; patented April 13, 1850 ; re-issued August 12, 1856.

Claim.—"1st, The combination of two or more properly shaped dies, between which a chair blank is clamped, prior to the cutting of that portion of it which constitutes the lips thereof, 2d, The automatic shears, in combination with properly shaped dies, for clamping a chair blank, and cutting the lips thereof. 3d, Such shears, when they also act as benders, to complete the formation of a chair lip, by reason of their having a motion in two directions. 4th, A double or parting clamp and die, so that a chair may be removed from the die upon which it is formed. 5th, Discharging a chair from a double or parting die, or its equivalent, by hooks, or their equivalents, acting to shove the chair off of a die. 6th, In combination, two clamping dies, one of which acts as a former, and divides at proper intervals shears. which also act as benders, or their equivalents, and a discharging apparatus, acting in respect to each other."

4. For an *Improvement in Reaping Machines;* Jonathan Read, Alton, Illinois ; patented March 12, 1842 ; extended March 12, 1856; re-issued August 19, 1856.

Claim.—"1st, The sickle, with its cutting edge when both scolloped and serrated. 2d, Reserving the serration on the edge of the sickle in short sections. 3d, Constructing the guard fingers in the shape of a spear head, for the purpose of affording a shoulder on each edge against which the grain will be held, thus counteracting its tendency to slip from the action of the sickle, and forming an acute-angled space in front of the edge of the sickle to render the severing of the grain more easy and certain."

5. For an *Improvement in Reaping Machines;* Jonathan Read, Alton, Illinois; patented March 12, 1842 ; extended March 12, 1856 ; re-issued August 19, 1856.

Claim.—"1st, The combination with the platform of a reaping machine, of a mechanical rake, which traverses said platform at intervals, and draws off the grain gathered thereon. 2d, The combination with a mechanical rake, of the roof or screen, or the equivalent thereof, to intervene and keep the gravel of grain collected on the platform separated during its discharge by the rake from the grain just cut, and falling towards the platform, thereby avoiding the scattering and entanglement which takes place when the grain passing off and that falling upon the platform are not kept separate. 3d, The combination with the roof or screen of a mechanical rake, of a stripper or guard, or its equivalent, to sweep from the screen any grain which may have fallen upon it during the passage of the rake to and fro over the platform. 4th, Constructing the platform with slats or ribs for the grain to lie on, and intermediate spaces for the teeth of the rake to run in to pass below the grain, and thus avoid all danger of overrunning and imperfectly discharging it."

6. For an *Improvement in Reaping Machines;* Jonathan Read, Alton, Illinois; patented March 12, 1842; extended March 12, 1856; re-issued August 19, 1856.

Claim.—" The combination of the reel for gathering the grain to the cutting apparatus, and depositing it on the platform, with the seat or position for the raker, to enable the raker to ride and rake the grain from the platform, and free the reel and cutting apparatus from obstructions."

7. For an *Improvement in Reaping Machines;* Jonathan Read, Alton, Illinois; patented March 12, 1842; extended March 12, 1856; re-issued August 19, 1856.

Claim.—" In combination with the main frame of the machine hung or balanced on the supporting wheels, and the thills or tongue by which the horses draw the machine hinged to the said frame, a lever connected with, or acting upon one, and extending to the driver's stand or seat on the other, so that the driver, who is the sole conductor of the machine, may, from said stand, by this arrangement, raise or depress the cutter at pleasure during the operation of the machine for cutting grain at any suitable height above the ground, or for passing over any intervening obstacles."

8. For an *Improvement in Harvesting Machines;* Jonathan Read, Alton, Illinois; patented March 12, 1842; extended March 12, 1856; re-issued August 19, 1856.

Claim.—" The arrangement of parts whereby a clear space is obtained, and the grain discharged between the platform and the path of the driving wheel, before the latter has passed the discharged grain."

9. For an *Improved Bomb-Lance for Killing Whales;* Christopher C. Brand, Norwich Connecticut; patented June 22, 1852; re-issued August 26, 1856.

Claim.—" The mode of sustaining the fuse rope in the fuse tube, and preventing the fire of the charge of the gun from passing by the fuse rope, and into the bomb, viz: by metal or metallic plugs, or the equivalents thereof, cast around or made to closely encompass the fuse rope after it has been inserted in the fuse tube. So making or applying them to the shaft shank, or to the body of the bomb, that not only may they be folded or moved down so as to be capable of entering with the shaft the bore of the gun, but each have an elastic property or spring, such as will cause it to unfold or be thrown outward. immediately after the projectile may be discharged from the gun; such wings being made of vulcanized india rubber, or any substance or substances which may be deemed an equivalent thereto, inasmuch as such may possess the requisites."

Designs for August, 1856.

1. For *Cooking Stoves;* N. S. Vedder, Assignor to Cox, Richardson & Boynton, Troy New York.

2. For *Cooking Stoves;* N. S. Vedder and Ezra Ripley, Assignors to Cox, Richardson & Boynton, Troy, New York.

3. For *Parlor Stoves;* David Hathaway, Assignors to Cox, Richardson & Boynton Troy, New York.

4. For *Six Plate Stoves;* N. S. Vedder and Ezra Ripley, Assignors to Swetland & Little, Crescent, New York.

5. For *Cooking Stoves;* N. S. Vedder and Wm. L. Sanderson, Assignors to Swetland & Little, Crescent, New York.

6. For *Cooking Stoves;* N. S. Vedder and Wm. L. Sanderson, Assignors to Swetland & Little, Crescent, New York.

Claims—To the above six patents, are for the ornamental designs, as represented in the drawings.

MECHANICS, PHYSICS, AND CHEMISTRY.

For the Journal of the Franklin Institute.

On the Construction of War Steamers.

To the Committee on Publications:

Gentlemen:—I wish to draw the attention of the "powers that be," to an useless incumbrance placed on our vessels of war, particularly those propelled by steam; as this retarding force is to be seen on all of the old vessels, it may almost be considered one of the cherished "institutions" of the Navy, yet I for one, think that *progress* should have ere now reformed this; but not so, for the "*Wabash*" is thus disfigured, and as the "*Minnesota*" has pump pipes outside, she no doubt will have the same incumbrance after being coppered.

At the time of building the former vessel, I noticed that the workmen were very particular in smoothing the planking of the bottom, and also that great attention was paid to the coppering, setting it up close to the planking. So far the beautiful formed lines of the Naval Constructor remained perfect; but next comes *four* large lead pipes, one at each quarter, and main chains, and over these more copper was put, projecting about three inches from the plane of the sides, altogether making over *seven and a half square feet of retarding surface under water.*

I will leave to the mathematicians of the Navy to estimate how many *barnacles* studded over the bottom would be equal to the pipes, and how much coal will be required to be carried on a voyage to overcome this worse than useless arrangement, which is an injustice to the Naval Constructor, and the builders of the machinery, who are conjointly responsible for the speed of the ship.

The water for the deck pumps could be obtained from the large pipes passing through the bottom for the supply of the steam engines, and then these lead pipes after being so attached, would be led fore and aft and up to any required point on the deck; so placed they would be more secured from injury and be no drawback. This may be thought a small matter by some, but it is by attention to trifles that perfection results, and in this case a *very slight* difference in speed may be of the utmost consequence in time of war; many things apparently trifling to a landsman, are cared for at sea; thus, rope's ends, &c., are not allowed to tow in the water; and on certain occasions (and very properly) sails are wetted to prevent air passing through the minute interstices of the close woven canvass.

In connexion with the above, I will point out a retarding force common to all side-wheel steamers, that is, placing the after beam too close to the periphery of the wheel, and, as the solid water leaves the paddle at a tangent, it impinges against this beam and re-acts against the wheel; again, there is a loss by there not being sufficient space between the edges of the bucket and the "house," converting it into a "*blower*," and of course consuming power; on the rivers of the West, it is no uncommon thing to have the wheel-house destroyed, and when this happens, the engine of that now always requires to be more "throttle" than before. All of the after part of the wheel-house should be open, with an oblique bulkhead to discharge the water, as is partially practised on some tow-boats.

While in the vein, permit me to write a word about *coal.* After every trial trip of a steamboat, you may read this or a similar sentence, "more speed would have been obtained but for the *inferior* quality of the coal." Strange to say, that on such occasions, although much expense and preparation is made for the inner man, yet the caterer for the food of the boilers always provides "*bad coal.*" Now, I contend that the *coal* on a trial-trip always does its duty, for boilers without soot or ashes in the flues, and no sediment or scale inside, will generate steam at that time the freest; it is true that the firemen may not have found out the best method of attending to the furnaces, for each boiler has its peculiarities, but this is a matter which has most to do with economy.

All know that the friction of new machinery at the time of starting, may absorb a large proportion of the power. A long time ago I was present at the starting of a stationary steam engine (by a firm famous for making *too* good fitting machinery), which under a pressure of 150 lbs. of steam to the square inch, and plenty of it, *for the coal was good then*,* the engine *alone* could not be got up to its speed for over half an hour, and yet before a week's running there was not a better performing engine before or since. If all makers of steam engines are not engineers, may not errors of construction have something to do with the disappointment of speed. These, with bad model, incumbrances to sides, &c., may all, or either, prevent the speed desired, *without disparaging the staple production of this State.* J.

* This anthracite coal was mined *up*, and as now the most of the coal in market comes from below the water line it must be better.

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*On a Peculiar Power possessed by Porous Media (Sand and Charcoal) of removing Matter from Solution in Water.** By HENRY M. WITT, F. C. S., Assistant Chemist to the Government School of Applied Science.

Communicated by the Author.

Various methods have been employed at different times for the purification of water for the supply of towns, but none has been found so practically convenient and efficacious as simple filtration through porous media, such as sand; moreover, charcoal being known to possess a peculiar power of removing *organic* matters from solution, this substance has been suggested and occasionally employed either as a substitute for, or an auxiliary to, ordinary sand filtration.

The following experiments were undertaken with a view of ascertaining by chemical analysis the more precise nature of the effects produced upon ordinary river-water, such as that of the Thames, by its passage through filters composed of these media respectively, and of comparing their powers; but it is believed that the results obtained possess an interest extending considerably beyond the question to assist in the solution of which they were made.

Before proceeding to the construction of experimental filters, I availed myself of the kindness of Mr. James Simpson, engineer to the Chelsea Water-works Company, to investigate the results obtained by that Company's system of filtration as carried on up to the present time at Chelsea;

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* From the Lond., Edin., and Dub. Philos. Mag., July, 1856.

and I have much pleasure in embracing the opportunity of expressing my obligation to this gentleman, and specially also his son, Mr. James Simpson, Jr., to whom I am greatly indebted for his very able co-operation throughout this inquiry.

The system of purification adopted by the Chelsea Water-works Company at their works at Chelsea, consisted hitherto (for the supply has by this time commenced from Kingston) in pumping the water up out of the river into subsiding reservoirs, where it remained for six hours; it was then allowed to run on to the filter beds. These are large beds of sand and gravel, each exposing a filtering surface of about 270 square feet, and the water passes through them at the rate of about 6¼ gallons per square foot of filtering surface per hour, making a total quantity of 1687·5 gallons per hour through each filter.

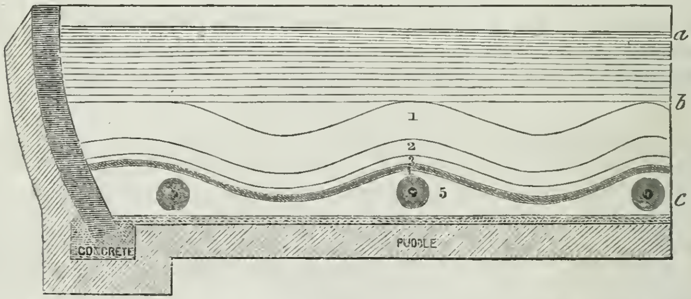
The filters are composed of the following strata in a descending order:

	ft.	in.
No. 1. Fine Sand, ...	2	6
" 2. Coarser Sand, ...	1	0
" 3. Shells, ...	0	6
" 4. Fine Gravel, ...	0	3
" 5. Coarse Gravel, ...	3	3

These several layers of filtering materials are not placed perfectly flat, but are disposed in waves, as seen in the sectional drawing; and below the convex curve of each undulation is placed a porous earthenware pipe, which conducts the filtered water into the mains for distribution.

Chelsea Water-works, Thames Bank. Transverse Section of Filter.

Downward Filtration.



a. Water line. *b.* Top of Fine Sand. *c.* Collecting drain (perforated).

Note.—Depth of water over the sand = 4 ft. 6 ins.

The upper layer of sand is renewed about every six months, but the body of the filter has been in use for about twenty years.

Samples of water were taken and submitted to examination—

1st. From the reservoir into which the water was at the time being pumped from the middle of the river.

2d. From the cistern after subsidence and filtration.

Experiments of this kind were made on three different occasions, viz: on the 12th of September and the 29th of December, 1855; and also on the 10th of May, 1856; and the results are embodied in Tables I., II., and III., each containing four columns,—No 1 showing the quantities of the several substances originally present, represented in grains in the imperial gallon (70,000 grains) of water; No. 2, the amounts present after filtration; No. 3, the actual quantities separated in grains in the gallon of water; and No. 4, the per centage ratio which the amounts separated bear to the quantities originally present.

Results of Filtration through Sand at the Chelsea Water-works.

TABLE I.—September 12, 1855.

	1. Originally present.	2. Present after filtration.	3. Amount separated.	4. Per centage ratio of separated matter.
Total solid residue (including suspended matter,)	65·527	41·290	24·237	36·98
Organic matter, . .	1·240	0·674	0·566	45·63
Total mineral matter, .	64·287	40·616	23·671	36·82
Suspended matter, . . .	16·112	. . . .	nearly	all.
Total soluble salts, . . .	48·175	40·616	7·559	15·69
Chlorine, ...	12·240	11·140	1·100	
Chloride of sodium, . .	20·170	18·357	1·820	9·23

TABLE II.—December 29, 1855.

	1. Originally present.	2. After filtration.	3. Amount separated.	4. Per centage ratio of separated matter.
Total solid residue (including suspended matter) . .	31·467	24·153	7·314	23·24
Organic matter, . . .	2·375	1·889	0·486	20·46
Total mineral matter, . .	29·092	22·264	6·828	23·47
Suspended matter, . .	7·035	1·403	5·632	80·05
Total dissolved salts, . .	22·057	20·861	1·196	5·42
Lime, ...	8·675	8·402	0·273	3·14
Chlorine, ...	1·667	1·546	0·121	7·25
Chloride of sodium, . .	2·747	2·547	0·200	7·28
Sulphuric acid, . . .	2·962	2·372	0·590	19·92

TABLE III.—May 10, 1856.

	1. Originally present.	2. After filtration.	3. Amount separated.	4. Per centage ratio of separated matter.
Total solid residue (including suspended matter,) .	55·60	22·85	32·75	58·90
Organic matter, .	4·05	1·349	2·70	66·66
Total mineral matter, .	51·55	21·501	30·049	58·29
Suspended matter, .	28·93	2·285	26·645	92·10
Total dissolved salts, .	22·62	19·216	3·404	15·04
Lime, . .	8·719	8·426	0·293	3·36

By these analytical results (if entitled to confidence, and I may state that all due care and attention were given to ensure their accuracy) it is shown that this process of mere sand filtration is one of more importance, and of a more peculiar and interesting character, than has generally been supposed.

It has been asserted as a principle that sand filtration *can* only remove bodies mechanically suspended in water, but I am not aware that this statement has been established by experiment; in fact, I am not acquainted with any published analytical examination of the effects of sand filtration.

These experiments supply the deficiency, and show moreover, that these porous media are not only capable of removing suspended matter (80 to 92 per cent.), but even of separating a *certain appreciable quantity of the* SALTS *from* SOLUTION *in water!* viz: from 5 to 15 per cent. of the amount originally present, 9 to 19 per cent. of the common salt, 3 per cent. of the lime, and 5 per cent of the sulphuric acid.

It is curious also, that the proportion of matter removed in this way depends to a certain extent upon the degree of impurity of the water; the greater the quantity of matter originally present in the water, the larger the per centage ratio of the salts removed, *e. g.*:—

	In Sept.	In Dec.	In May.
Total impurity of water, . .	65·527	31·467	55·90
Per centage of salts removed, . .	15·69	5·42	15·04

This point will, however, become more apparent by comparing these experiments with those made at Kingston, where the water is much purer, to which I shall have occasion hereafter more particularly to refer.

This fact, of the power possessed by sand and other porous media, which rests for demonstration not only upon the three preceding experiments, but also upon others to be presently described, is one of great importance, not only in a hygienic and economic point of view as relating to the great question of water supply, but also in its bearings upon agriculture and geology.

It is possible that soils may remove matters from solution in water, not only by decompositions between the contained salts and the aluminous silicates of the soil, (as demonstrated by Mr. Way,) but also in virtue of this peculiar action.

Again, water containing considerable quantities of saline matter in solution may, by merely percolating through *great masses* of porous strata during *long periods*, be gradually deprived of its salts to such an extent as probably to render even sea-water fresh.

This may, in fact, be one of the causes contributing towards the production of fresh water springs which ebb and flow with the tide in the vicinity of the sea: for instance, Darwin, in the "Voyage of the Beagle" (vol. iii. p. 545), mentions that on Keeling Island, one of the coral reefs near the coast of Sumatra, there are fresh water wells which ebb and flow with the tide. Mr. Darwin, however, suggests another explanation of this phenomenon; he says that "at first sight it would appear not a little remarkable that the fresh water should regularly ebb and flow with the tide. We must believe that the compressed sand or porous coral rock acts like a sponge, and that the rain-water which falls on the ground being specifically lighter than salt, floats on its surface, and is subject to the same movements. There can be no actual attraction between salt and fresh water, and the spongy texture must tend to prevent all admixture from slight disturbances. On the other hand, where the foundation consists only of loose fragments, upon a well being dug, salt or brackish water enters, of which fact we saw an instance on this small island."

Now I would not presume to deny the accuracy of this explanation; still it is possible that the phenomenon may be a mixed one, and that the peculiar power which I have found to be possessed by porous media may contribute towards the result by abstracting a portion (at least) of the salts from the sea-water during its passage through the porous rock.

Moreover, there are certain difficulties in Mr. Darwin's explanation. If the sand did not possess the power of removing salts from solution, to a certain extent at all events, the rain-water inside would tend, more or less rapidly, to become salt by the commixture with it of the sea-water from without, which would take place through the porous diaphragm so much the more readily on account of their difference of density, in virtue of the "osmotic force" so ably investigated by Professor Graham. Indeed, the last fact mentioned by Mr. Darwin, viz: that when the wall consists of loose fragments the wells are salt, tends to show that it is only the very finely divided sand, the porous medium offering a considerable extent of surface, which possesses the power of removing the salts, for if the non-commixture of the salt and fresh water arose only from their difference of density, the coarseness of the diaphragm would not materially affect it.

As to the *cause* of this peculiar action, the only suggestion which I may venture to offer is, that it possibly arises from the weak chemical affinity in virtue of which salts are held in solution in water, being overcome by a physical force, the attraction of cohesion, or more properly adhesion, exerted by the greatly extended surface of the porous body; this is not a solitary instance of such weak chemical forces as solution being overcome by a physical attraction. Gmelin* instances several other examples of the power of the physical force of "*adhesion*" to overcome weak chemical attractions, *e. g.:* "When vinegar is filtered through quartz sand, the first portion of liquid that runs through is robbed of almost all its acid, and the vinegar does not pass through unchanged until the sand has become well charged with acid. Potato brandy diluted with water, and filtered through quartz sand, yields at first pure water, then a mixture of water and alcohol deprived of its fusel oil, and lastly, the original mixture unaltered: wood shavings also deprive vinegar of nearly all its acid; charcoal acts still more powerfully.†

Now it is possible that these being organic compounds they may be oxidized, even into carbonic acid and water, under these circumstances; but whatever difference of opinion may arise respecting the *cause*, this cannot affect the simple experimental fact.

It will naturally be asked, if sand possess this power, Are not the salts removed from the water accumulated in the sand, and would not this throw light upon the mode of formation of sandstone conglomerate rocks? To enable me to reply to this question, I have in my possession samples of sand, before use, and also after employment in the middle of the filter at Chelsea for no less than twenty years, and their analysis will form the subject of a future communication; pressure of other duties having hitherto prevented me from the completion of this important point in the inquiry.

But, as before mentioned, the preceding are not the only experiments which I have made on this subject: the following were performed at

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* Handbook of Chemistry, Cavendish Society's Translation, vol. i. p. 114.

† Wagenmann, Poggendorff's *Annalen*, xxiv. 600.

Kingston, where the water is far purer, more particularly for the purpose of ascertaining the effects of charcoal and comparing its powers with those of sand.

At the time these experiments were in progress, the Company's filter-beds at Kingston, now just completed, were finished, and consequently, in order to ascertain the effects both of sand and charcoal on the comparatively pure water of Kingston, it became necessary to construct smaller experimental filters.

The earlier experiments were upon the effects of charcoal, and several preliminary trials were made for the purpose of ascertaining the form of filter and rate of filtration which would nearest approximate to the operation as carried on on the large scale.

In the first of these experiments, to which attention may be drawn, the water was pumped from the river into a cistern of slate, where a deposition of the greater portion of the suspended matter took place; it was then conducted into the upper part of the right-hand compartment of a nearly cubical wooden cistern, this right-hand compartment being separated from the one on the left by a porous diaphragm, the walls of which were of wire gauze, and the interior filled with fragments of oak charcoal, about the size of a hazel nut to a walnut: this charcoal diaphragm exposed a filtering surface of about 5·38 square feet; the filtration was lateral and descending, the water entering at the upper part of the right-hand compartment, and passing out at the lower extremity of the left-hand division; the rate of filtration being half a gallon per minute.

A sample of the water was analyzed before passing into the filter, and after coming from it, after the continuance of the operation for a certain number of hours. The results were as follows:

TABLE IV.

	Original water used.	After 67 hours action.			After 91 hours action.		
		Comparison.	Amount separated.	Per centage ratio of quantity separated.	Comparison.	Amount separated.	Per centage ratio of quantity separated.
Total residue, .	23·949	23·668	0·281	1·17	22·076	1·873	7·82
Mineral salts, . .	22·519	. . . .	. . . .	. . . .	21·618	0·901	4·00
Organic matter, .	1·430	0·475	0·955	66·78	0·458	0·972	68·00
Chlorine, . . .	1·054	. . . .	. . . .	. . . .	0·9731	0·081	7·685
Chloride of sodium	1·737	. . . .	. . . .	. . . .	1·603	0·134	7·714
		After 115 hours action.			After 139 hours action.		
Total residue, .	23·949	23·012	0·937	3·91	23·411	0·538	2·242
Mineral salts, . .	22·519	. . . .	. . . .	. . . .	22·44	0·079	3·66
Organic matter,	1·430	0·620	0·810	56·67	0·971	0·459	32·10
Chlorine, - . .	1·054	0·885	0·169	16·03	0·973	0·081	9·73
Chloride of sodium	1·737	1·457	0·280	16·10	1·603	0·134	9·8

This experiment exhibits more strikingly perhaps than any of the others, the very curious circumstance that in the employment of charcoal the amount of impurity separated by it goes on increasing to a certain point, and then diminishes; to which, however, I must again more particularly allude after describing the experiment comparing sand and charcoal, simultaneously; it demonstrates also very satisfactorily the power possessed by charcoal, like sand, of removing not only suspended matters, but also soluble salts, *e. g.* chloride of sodium: but to this point I shall again refer.

Although very satisfactory as showing the power of charcoal under the circumstances of the experiment, yet it being probable that by employing the charcoal in lumps, as was done, it had not a fair chance of exhibiting its peculiar properties, inasmuch as only very imperfect contact was effected between the impurities contained in the water and the particles of charcoal, it was resolved to try an experiment with charcoal in powder, or nearly so, in granules of the size of a pea. Moreover, even then we should have succeeded only in proving the *absolute* effect of charcoal, for we have learnt that the results thus obtained did not admit of comparison with those of filtration through sand at Chelsea, on account of the great difference in the original composition of the water; therefore, in order to establish at the same time the absolute effect of charcoal as a filtering medium upon the purer water at Kingston, and also to compare it with that of sand, two experiments were made simultaneously with the same water, the one of filtration through charcoal alone, and the other through sand alone, both under precisely similar circumstances. In both these experiments the filtration was not effected laterally as in the foregoing case, but *downwards* in the usual way through beds of the same size of the respective filtering media contained in wooden troughs, the water being admitted at the top and passing off from below.

The sand-filter had an area of 4 square feet, and consisted of the following materials:—

	ft.	ins.
Fine sand, . . .	1	9
Shells, . . .	0	1½
Gravel, . . .	0	1½
Coarse Gravel, . .	0	9
	2	9

The rate of filtration being half a gallon per minute.

TABLE V.—*Results of Sand Filtration.*

	Original water used.	After 23 hours action.			After 120 hours action.		
		Comparison.	Amount separated.	Per centage ratio of quantity separated.	Comparison.	Amount separated.	Per centage ratio of quantity separated.
Total residue, .	24·578	23·87	0·708	2·88	23·69	0·888	3·613
Mineral salts, . .	23·687	22·858	0·829	3·50	23·04	0·647	2·73
Organic matter, .	0·8906	1·012	. . . .	. . . .	0 648	0·2426	
Suspended matter,	3·509	2·663	0·846	24·109			
Chlorine, . . .	0·862	. . . .	. . . .	. . . .	0·671	0·191	22·16
Chloride of sodium	1·420	. . . .	. . . .	. . . .	1·105	0·315	22·11
		After 240 hours action.			After 376 hours action.		
Total residue, .	24·578	22·534	2·044	8·316	22·507	2·071	8·426
Mineral salts, . .	23·687	21·517	2·170	9·161	21·698	1·989	8·397
Organic matter, .	0·8906	0·915	. . . .	. . . .	8·809		
Suspended matter,	3·509	1·88	1·629	46·423	1·584	1·925	54·85
Chlorine, . . .	0·862	0·674	0 188	21·8			
Chloride of sodium,	1·420	1·110	0·310	21·8			

Apart from its special interest, as compared with the following experiment made simultaneously through charcoal, the following points are in themselves remarkable in the results obtained by this filtration through sand:—

1st. That the filter continued increasing in efficacy even till the conclusion of the experiment, *i. e.* for 376 hours, not having lost any of its power when the experiment was terminated.

2d. That no weighable quantity of dissolved organic matter was removed by the sand in this experiment; but it must be remembered that the quantity originally present was but small.

3d. Its power of removing soluble salts was considerable; as a maximum, 21 per cent. of the common salt being separated.

TABLE VI.—*Results of Charcoal Filtration.*

	Original water used.	After 120 hours action.			After 120 hours action.		
		Comparison.	Amount separated.	Per centage ratio of quantity separated.	Comparison.	Amount separated.	Per centage ratio of quantity separated.
Total residue, .	24·578	22·13	2·448	9·906	21·644	2·934	11·93
Mineral matter, .	23·687	21·375	2·312	9·76			
Organic matter, .	0·8906	0·755	0·1356	15·22			
Suspended matter,	3·509	....	....	....	3·06	0·449	12·79
Chlorine, . . .	0·862						
Chloride of sodium,	1·420						
		After 240 hours action.			After 376 hours action.		
Total residue, .	24·578	20·821	3·757	15·28	21·374	3·204	13·03
Mineral matter, .	23·687	....	....	....	20·604	3·033	12·34
Organic matter, .	0·8906	....	....	....	0·770	0·1206	13·54
Suspended matter,	3·509	2·79	0·719	20·43			
Chlorine, . . .	0·862						
Chloride of sodium,	1·420						

On comparing this experiment with the preceding, the following points come out as showing the difference between the effects of sand and charcoal as filtering media.

1st. By the charcoal, speaking generally, a considerably larger quantity of the total residue contained in the water was removed than by the sand, their maximum results being respectively as follows:—

Amount originally present.	Amount separated in grains in the gallon.		Amount separated in per centage of the quantity present.	
	By sand.	By charcoal.	By sand.	By charcoal.
24·578 grs. in the gallon.	2·074	3·757	8·426	15·28

But, as might have been anticipated from the well-known power of charcoal to remove organic principles from solution in water, its superiority over sand is more especially observable in this respect; no weighable quantity of organic matter being separated by the sand, whilst 15 per cent. of the quantity present was removed by the charcoal.

Nevertheless the case is quite altered when more impure water is filtered through the same medium; for instance, it will be remembered that sand does remove organic matter from water when the quantity present is somewhat greater. Thus, in Tables I., II., and III., it is shown that at Chelsea, where the quantity of organic matter present in the water rose to 2·375 grs. in the gallon, then the sand removed 20·46 per cent.; when the quantity present amounted to 4·05 grs. 66·66 per cent.; and lastly, when to 9·909 grs., no less than 95·23 per cent. was removed!

Now this is a most striking and important result in a hygienic point of view. The evil consequences said to result from the water supply of London at present in use are mainly attributed to the organic matter present in the water; but these analyses show that the more impure the water (within certain limits), the greater is the power of porous filtering media to remove these impurities, probably from the more perfect contact between the filtering medium and the impurities present. It is obvious that this would not go on *ad infinitum;* it must not be supposed that I wish it to be inferred that the more organic matter there is present in a water, the more would necessarily be removed by sand filtration; quite the contrary, it is highly probable that if the quantity had increased much beyond what was contained at the time of the performance of these experiments, a considerable amount might have passed through unrestrained; all I wish to be understood is, that *within the limits of the quantities present* when these experiments were made, *sand was found incapable* of removing any appreciable quantity of organic matter when the amount originally present in the water was *exceedingly small;* but that in the same ratio as the quantity present increased, the *proportion separated rose.*

Now the power of charcoal, I believe, increases in a similar manner; but no experiments could conveniently be made on the large scale at Chelsea to enable me to draw a strict comparison between the effects of sand and charcoal upon the more impure water there, similar to what had been made at Kingston with the comparatively pure water; therefore to enable me to adduce experimental evidence on this point, a comparative experiment was made on the small scale with an artificially prepared impure water.

This water was prepared as follows:—To the sample of Thames water collected at Kingston on the 8th of October, 1855, cow-dung and garden mould were added, in the proportion of 4 ozs. of solid cow-dung (without straw) and 4 ozs. of garden mould to two gallons of the water; the whole was allowed to digest for a week, being frequently shaken during this period; it was then allowed to settle for twelve hours, and the supernatant fetid fluid poured off and submitted to examination. It was found to contain in the gallon—

Total residue, . . .	71·772 grs.
Organic matter, . .	29·308 "
Mineral matter, . . .	42·468 "

And the results obtained by filtration respectively through sand and charcoal are contained in the following Tables:—

Table VII.—*Action of Vegetable Charcoal on Artificially Impure Water.*

	Original constituents.	Present after filtration.	Amount separated in grains in the gallon.	Per centage ratio of matter separated.
Total residue,	71·772	33·86	37·912	52·82
Organic matter,	29·308	3·50	25·808	88·05
Mineral salts,	42·464	30·36	12·104	28·26

Table VIII.—*Action of Sand.*

	Original constituents.	Present after filtration.	Amount separated in grains in the gallon.	Per centage ratio of matter separated.
Total residue,	71·772	70·23	1·542	2·14
Organic matter,	29·308	27·85	1·458	4·97
Mineral salts,	42·464	42·38	0·084	0·197

It must be borne in mind that these two experiments being made only on the small scale in the laboratory, though strictly comparable with each other, do not admit of comparison with any of the others; they serve only to demonstrate how far greater is the power possessed by charcoal of removing organic matters from solution than that of sand, though the difference in their action on soluble inorganic salts is less marked.

Another point of distinction between the effects of charcoal and sand upon the Thames water at Kingston was this—that whereas the efficacy of the sand-filter continued increasing even up to the conclusion of the experiment, the amount of impurity separated by the charcoal arrived in all cases at a maximum after a certain number of hours, and then began to decrease, as will be more perspicuously shown by the following Table :—

Table IX.—*Showing the period of maximum efficacy of the several filters.*

Amounts of total residue origin'lly present in each case.	Number of hours action of the filter	Amount separated in grains in the gallon by			Per centage ratio of quantity separated by		
		Sand.	Charcoal in granules.	Charcoal in lumps.	Sand.	Charcoal in granules.	Charcoal in lumps.
grs.	hrs.						
24·578	23	0·708	2·868	....	2·88	11·66	
23·949	67	..	....	0·281	..	....	1·17
23·949	91	..	....	1·873	..	....	7·82
23·949	115	..	....	0·937	..	....	3·91
24·578	120	0·888	2·934	....	3·613	11·93	
23·949	139	..	....	0·538	..	....	2·242
24·578	240	2·044	3·757	....	8·316	15·28	
24·578	376	2·071	3·204	....	8·426	13·03	

Lastly, these experiments upon the comparatively pure water of Kingston, show that CHARCOAL, *as well as sand*, is capable of separating *mineral* salts from *solution* in water, as is evident by an inspection of the foregoing Tables.

The following is a brief summary of the most important results of this investigation :—It has been shown,—

1st. That sand, charcoal, and probably other porous media, possess the very peculiar property of removing, not merely suspended impurities, but even dissolved salts from solution in water.

2d. That charcoal enjoys pre-eminently the power of abstracting organic matter from solution; but that even sand likewise is capable of effecting the same result, though to a far less extent.

3d. That these powers, possessed by both these media, increase in intensity to a certain extent with the degree of impurity of the solution.

4th. That these properties of porous media have important bearings upon hygienic science, agricultural principles, and geological phenomena.

The reader will not fail to have noticed, by the various analyses given above, great variations in the composition of the river-water, between the two points at which experiments were made, viz: at Chelsea and Kingston, as well as at the different seasons of the year. To a number of analyses made during the year since May 1855, I hope to draw attention in a subsequent paper as elucidating these facts.

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*On the Manufacture of Malleable Iron and Steel without Fuel.**

By H. Bessemer.

"The manufacture of iron in this country has attained such an important position that any improvement in this branch of our national industry cannot fail to be a source of general interest, and will, I trust, be a sufficient excuse for the present brief, and, I fear, imperfect paper. I may mention that for the last two years my attention has been almost exclusively directed to the manufacture of malleable iron and steel, in which, however, I had made but little progress until within the last eight or nine months. The constant pulling down and re-building of furnaces, and the toil of daily experiments with large charges of iron, had already begun to exhaust my stock of patience; but the numerous observations I had made during this very unpromising period, all tended to confirm an entirely new view of the subject, which at that time forced itself upon my attention—viz: that I could produce a much more intense heat without any furnace or fuel than could be obtained by either of the modifications I had used, and consequently that I should not only avoid the injurious action of mineral fuel on the iron under operation, but that I should at the same time avoid also the expense of the fuel. Some preliminary trials were made on from 10 lbs. to 20 lbs. of iron, and, although the process was fraught with considerable difficulty, it exhibited such unmistakable signs of success as to induce me at once to put up an apparatus capable of converting about 7 cwt. of crude pig-iron into malleable iron in 30 minutes. With such masses of metal to operate on, the difficulties which beset the small laboratory experiments of 10 lbs., entirely disappeared. On this new field of inquiry I set out with the assumption that crude iron contains about 5 per cent. of carbon; that carbon cannot exist at a white heat in the presence of oxygen without uniting therewith and producing combustion; that such combustion would proceed with a rapidity dependent on the amount of surface of carbon exposed; and, lastly, that the temperature which the metal would acquire would be also dependent on the rapidity with which the oxygen and

*From the Lond. Civ. Eng. and Arch's. Jour., Sept., 1856.

carbon were made to combine, and consequently that it was only necessary to bring the oxygen and carbon together in such a manner that a vast surface should be exposed to their mutual action, in order to produce a temperature hitherto unattainable in our largest furnaces. With a view of testing practically this theory, I constructed a cylindrical vessel of three feet in diameter and five feet in height, somewhat like an ordinary cupola furnace, the interior of which is lined with fire bricks, and at about two inches from the bottom of it I inserted five tuyere pipes, the nozzles of which are formed of well-burnt fire clay, the orifice of each tuyere being about three-eighths of an inch in diameter; they are so put into the brick lining (from the outer side) as to admit of their removal and renewal in a few minutes when they are worn out. At one side of the vessel, about half way up from the bottom, there is a hole made for running in the crude metal, and on the opposite side there is a tap-hole stopped with loam, by means of which the iron is run out at the end of the process. In practice this converting vessel may be made of any convenient size, but I prefer that it should not hold less than one, nor more than five tons, of fluid iron at each charge. The vessel should be placed so near to the discharge hole of the blast furnace as to allow the iron to flow along the gutter into it; a small blast cylinder will be required capable of compressing air to about 8 lbs. or 10 lbs. to the square inch. A communication having been made between it and the tuyeres before named, the converting vessel will be in a condition to commence work; it will, however, on the occasion of its first being used after relining with fire-bricks, be necessary to make a fire in the interior with a few baskets of coke, so as to dry the brick-work and heat up the vessel for the first operation, after which the fire is to be all carefully raked out at the tapping hole, which is again to be made good with loam. The vessel will then be in readiness to commence work, and may be so continued without any use of fuel until the brick lining in the course of time becomes worn away and a new lining is required. I have before mentioned that the tuyeres are situated nearly close to the bottom of the vessel; the fluid metal will therefore rise some 18 inches or 2 feet above them. It is therefore necessary, in order to prevent the metal from entering the tuyere holes, to turn on the blast before allowing the fluid crude iron to run into the vessel from the blast furnace. This having been done, and the fluid iron run in, a rapid boiling up of the metal will be heard going on within the vessel, the metal being tossed violently about and dashed from side to side, shaking the vessel by the force with which it moves. From the throat of the converting vessel, flame will then immediately issue, accompanied by a few bright sparks. This state of things will continue for about fifteen or twenty minutes, during which time the oxgen in the atmospheric air combines with the carbon contained in the iron, producing carbonic acid gas, and at the same time evolving a powerful heat. Now, as this heat is generated in the interior of, and is diffused in innumerable fiery bubbles through, the whole fluid mass, the metal absorbs the greater part of it, and its temperature becomes immensely increased, and by the expiration of the fifteen or twenty minutes before named that part of the carbon which appears mechanically mixed and diffused through the crude iron has been entirely consumed. The temperature, however, is so high that the chemically combined carbon now begins to separate from the metal, as is at once indicated by an immense increase in the volume of flame rushing out of the throat of the vessel. The metal in the vessel now rises several inches above its natural level, and a light frothy slag makes its appearance, and is thrown out in large foam-like masses. This violent eruption of cinder generally lasts about five or six minutes, when all further appearance of it ceases, a steady and powerful flame replacing the shower of sparks and cinder which always accompanies the boil. The rapid union of carbon and oxygen which thus takes place adds still further to the temperature of the metal, while the diminished quantity of carbon present allows a part of the oxygen to combine with the iron, which undergoes combustion and is converted into an oxide. At the excessive temperature that the metal has now acquired the oxide as soon as formed undergoes fusion, and forms a powerful solvent of those earthy bases that are associated with the iron. The violent ebullition which is going on mixes most intimately the scoria and metal, every part of which is thus brought in contact with the fluid oxide, which will thus wash and cleanse the metal most thoroughly from the silica and other earthy bases which are combined with the crude iron, while the sulphur and other volatile matters which cling so tenaciously to iron at ordinary temperatures are driven off, the sulphur combining with the oxygen and forming sulphurous acid gas. The loss in weight of crude iron during its conversion into an ingot of malleable iron was found on a mean of four experiments to be 12½ per cent., to which will have to be added the loss of metal in the finishing rolls. This will make the entire loss probably not less than 18 per cent., instead of about 28 per cent., which is the loss on the present system. A large portion of this metal is, however, recoverable by treating with carbonaceous gases the rich oxide thrown out of the furnace during the boil. The slags are found to contain innumerable small grains of metallic iron, which are mechanically held in suspension in the slags, and may be easily recovered. I have before mentioned that after the boil has taken place a steady and powerful flame succeeds, which continues without any change for about ten minutes, when it rapidly falls off. As soon as this diminution of flame is apparent, the workmen will know that the process is completed, and that the crude iron has been converted into pure malleable iron, which he will form into ingots of any suitable size and shape by simply opening the tap-hole of the converting vessel and allowing the fluid malleable iron to flow into the iron ingot moulds placed there to receive it. The masses of iron thus formed will be perfectly free from any admixture of cinder, oxide, or other extraneous matters, and will be far more pure and in a forwarder state of manufacture than a pile formed of ordinary puddle bars. And thus it will be seen that by a single process, requiring no manipulation or particular skill, and with only one workman, from three to five tons of crude iron passes into the condition of several piles of malleable iron in from thirty to thirty-five minutes, with the expenditure of about one-third part the blast now used in a finery furnace with an equal charge of iron, and with the consumption of no other fuel than is contained in the crude iron. To those who are best acquainted with the nature of fluid iron it may be a matter of surprise that a blast of cold air forced into melted crude iron is capable of raising its temperature to such a degree as to retain it in a perfect state of fluidity after it has lost all its carbon, and is in the condition of malleable iron, which in the highest heat of our forges only becomes softened into a pasty mass. But such is the excessive temperature that I am enabled to arrive at with a properly shaped converting vessel and a judicious distribution of the blast, that I am enabled not only to obtain the fluidity of the metal, but to create so much surplus heat as to re-melt the crop ends, ingot runners, and other scrap that is made throughout the process, and thus bring them without labor or fuel into ingots of quality equal to the rest of the charge of new metal. For this purpose a small arched chamber is formed immediately over the throat of the converting vessel, somewhat like the tunnel head of the blast furnace. This chamber has two or more openings on the sides of it, and its floor is made to slope downwards to the throat. As soon as a charge of fluid malleable iron has been drawn off from the connecting vessel, the workmen will take the scrap intended to be worked into the next charge, and proceed to introduce the several pieces into the small chamber, piling them up around the opening of the throat. When this is done he will run his charge of crude metal, and again commence the process. By the time the boil commences the bar ends or other scrap will have acquired a white heat, and by the time it is over most of them will have been melted and run down into the charge. Any pieces, however, that remain may then be pushed in by the workman, and by the time the process is completed they will all be melted, and ultimately combined with the rest of the charge, so that all scrap iron, whether cast or malleable, may thus be used up without any loss or expense. As an example of the power that iron has of generating heat in this process, I may mention a circumstance that occurred to me during my experiments; I was trying how small a set of tuyeres could be used; but the size chosen proved to be too small, and after blowing into the metal for one hour and three-quarters I could not get up heat enough with them to bring on the boil. The experiment was therefore discontinued, during which time two-thirds of the metal solidified and the rest was run off. A larger set of tuyere pipes were then put in, and a fresh charge of fluid iron run into the vessel, which had the effect of entirely re-melting the former charge, and when the whole was tapped out it exhibited as usual that intense and dazzling brightness peculiar to the electric light.

"To persons conversant with the manufacture of iron it will be at once apparent that the ingots of malleable metal which I have described will have no hard or steely parts, such as is found in puddle iron, requiring a great amount of rolling to blend them with the general mass, nor will such ingots require an excess of rolling to expel cinder from the interior of the mass, since none can exist in the ingot, which is pure and perfectly homogeneous throughout, and hence requires only as much rolling as is necessary for the development of fibre; it therefore follows that, instead of forming a merchant bar or rail by the union of a number of separate pieces welded together, it will be far more simple and less expensive to make several bars or rails from a single ingot; doubtless this would have been done long ago had not the whole process been limited by the size of the ball which the puddler could make.

"The facility which the new process affords of making large masses will enable the manufacturer to produce bars that on the old mode of working it was impossible to obtain; while, at the same time, it admits of the use of some powerful machinery whereby a great deal of labor will be saved, and the process be greatly expedited. I merely mention this fact in passing, as it is not my intention at the present moment to enter upon any details of the improvements I have made in this department of the manufacture, because the patents which I have obtained for them are not yet specified. Before, however, dismissing this branch of the subject, I wish to call the attention of the meeting to some of the peculiarities which distinguish cast steel from all other forms of iron, namely, the perfect homogeneous character of the metal, the entire absence of sand cracks or flaws, and its greater cohesive force and elasticity as compared with the blister steel from which it is made, qualities which it derives solely from its fusion and formation into ingots, all of which properties malleable iron acquires in like manner by its fusion and formation into ingots in the new process. Nor must it be forgotten that no amount of rolling will give to blister steel (although formed of rolled bars) the same homogeneous character that cast steel acquires by a mere extension of the ingot to some 10 or 12 times its original length.

"One of the most important facts connected with the new system of manufacturing malleable iron is, that all the iron so produced will be of that quality known as charcoal iron, not that any charcoal is used in its manufacture, but because the whole of the processes following the smelting of it are conducted entirely without contact with or the use of any mineral fuel; the iron resulting therefrom, will, in consequence, be perfectly free from those injurious properties which that description of fuel never fails to impart to iron that is brought under its influence. At the same time this system of manufacturing malleable iron offers extraordinary facility for making large shafts, cranks, and other heavy masses; it will be obvious that any weight of metal that can be founded in ordinary cast iron by the means at present at our disposal may also be founded in molten malleable iron, and be wrought into the forms and shapes required, provided that we increase the size and power of our machinery to the extent necessary to deal with large masses of metal. A few minutes' such reflection will show the great anomaly presented by the scale on which the consecutive processes of iron-making are at present carried on. The little furnaces originally used for smelting ore have from time to time increased in size, until they have assumed colossal proportions, and are made to operate on 200 or 300 tons of material at a time, giving out 10 tons of fluid metal at a single run. The manufacturer has thus gone on increasing the size of his smelting furnaces, and adapting to their use the blast apparatus of the requisite proportions, and has, by this means, lessened the cost of production in every way; his large furnaces require a great deal less labor to produce a given weight of iron than would have been required to produce it with a dozen furnaces, and in like manner he diminishes his cost of fuel blast and repairs, while he insures a uniformity in the result that could never have been arrived at by the use of a multiplicity of small furnaces. While the manufacturer has shown himself fully alive to these advantages, he has still been under the necessity of leaving the succeeding operations to be carried out on a scale wholly at variance with the principles he has found so advantageous in the smelting department. It is true that hitherto no better method was known than the puddling process, in which from 400 to 500 weight of iron is all that can be operated upon at a time, and even this small quantity is divided into homœopathic doses of some 70 lbs. or 80 lbs., each of which is moulded and fashioned by human labor, carefully watched and tended in the furnace, and removed therefrom one at a time to be carefully manipulated and squeezed into form. When we consider the vast extent of manufacture, and the gigantic scale on which the early stages of progress is conducted, it is astonishing that no effort should have been made to raise the after processes somewhat nearer to a level commensurate with the preceding ones, and thus rescue the trade from the trammels which have so long surrounded it.

"Before concluding these remarks I beg to call your attention to an important fact connected with the new process, which affords peculiar facilities for the manufacture of cast steel.

"At the stage of the process immediately following the boil, the whole of the crude iron has passed into the condition of cast steel of ordinary quality; by the continuation of the process the steel so produced gradually loses its small remaining portion of carbon, and passes successively from hard to soft steel, and from soft steel to steely iron, and eventually to very soft iron; hence at a certain period of the process any quality of metal may be obtained; there is one in particular, which by way of distinction I call semi-steel, being in hardness about midway between ordinary cast steel and soft malleable iron. This metal possesses the advantage of much greater tensile strength than soft iron; it is also more elastic, and does not readily take a permanent set, while it is much harder and is not worn or indented so easy as soft iron; at the same time it is not so brittle or hard to work as ordinary cast steel. These qualities render it eminently well adapted to purposes where lightness and strength are specially required, or where there is much wear, as in the case of railway bars, which from their softness and lamellar texture soon become destroyed. The cost of the semi-steel will be a fraction less than iron, because the loss of metal that takes place by oxidation in the converting vessel is about 2½ per cent. less than it is with iron; but, as it is a little more difficult to roll, its cost per ton may fairly be considered to be the same as iron; but, as its tensile strength is some 30 or 40 per cent. greater than bar iron, it follows that for most purposes a much less weight of metal may be used, so that taken in that way the semi-steel will form a much cheaper metal than any we are at present acquainted with.

"In conclusion, allow me to observe that the facts which I have had the honor of bringing before the meeting have not been elicited from mere laboratory experiments, but have been the result of working on a scale nearly twice as great as is pursued in our largest iron works, the experimental apparatus doing 7 cwt. in 30 minutes, while the ordinary puddling furnace makes only 4½ cwt. in two hours, which is made into six separate balls, while the ingots or blooms are smooth, even prisms, 10 inches square, by 30 inches in length, weighing about equal to ten ordinary puddle balls."

Mr. Bessemer's process has, since the reading of his paper before the British Association, been put to a severe practical test, with the most successful result, at Baxter house, St. Pancras road, in the presence of several iron masters, practical engineers, and scientific men resident in the metropolis.

Men like the two Rennies, Nasmyth, and others of minor note, but of great experience as engineers and iron manufacturers, have pronounced emphatically and without qualification in its favor, whilst some, including Nasmyth, declare themselves unable to foresee the whole of the advantageous results, calculated to spring from its discovery, not to this country alone, but wherever else it may be brought into use.

In conducting the demonstration, 6 cwt. 3 qrs. 18 lbs. of molten iron from a furnace was poured into the fire-brick vessel, already described, at twelve minutes past one o'clock, the blast having been applied at a pressure about 8 lbs. per square inch, and continued until twenty-seven minutes past one. The mass of metal began to boil up, and the cinders and other impurities were extruded from the top of the vessel by two apertures provided for the purpose. Showers of brilliant sparks were thrown off during this process, which lasted several minutes; and as the object was to produce a mass of cast steel, rather than continue the process to the extent necessary for making pure iron free from carbon, the vessel was tapped at thirty-six minutes past one and the contents drawn off. Small specimen ingots being first taken, the general mass was run into an ingeniously contrived mould concealed in the floor in front of the apparatus, and, after remaining there a few minutes, cooling down, it was raised out of the mould in a red-hot state by an hydraulic ram, and placed upon a weighing machine. The ingot thus produced, with the two specimen ingots, weighed 6 cwt. Without the aid of fuel, this mass of material was converted in twenty-four minutes from crude cast iron as it comes from the blast furnace, into steel of fine quality.

The experiment was unanimously pronounced by the company to be perfectly satisfactory. It is a peculiar and important feature in the process, that by continuing the boiling a few minutes longer the whole of the carbon still remaining in the mass of metal, and which gives to it the character known as steel, would have been drawn off, and a pure mass of crystalline iron would have been the result.

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*Mr. Bessemer's Discovery.** By C. Sanderson, of Sheffield.

The metallurgical world has been paralyzed not only by the statement set forth at the meeting of the British Association, at Cheltenham, but by the details given in the *Times* of a trial made in London to exhibit Mr. Bessemer's process for producing malleable iron, fine steel, or any mixture of the two which might be required in the arts or by engineers, from crude iron.

The public is justified in receiving the statements made, because it seems impossible to doubt their accuracy. The invention is momentous, involving immense interests, both in the steel and iron trade. It has, like a meteor, shot across the beaten path of science, and dazzled us all by its apparant brilliancy. Having had some experience in the manufacture of both iron and steel, I propose to give the result of such experience, as well as my opinion of this novel mode of manufacture.

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* From the Lond. Mech. Mag., August, 1856.

Mr. Bessemer runs crude fluid iron into a small cupola-formed vessel: about 7 cwt. of metal only has hitherto been operated upon, but he can as easily act upon 5 tons. A blast issuing through five tuyeres is driven into the metal at 8 lbs. or 10 lbs. pressure; and the effect obtained is, that the oxygen of the blast, uniting with the carbon, produces carbonic acid or carbonic oxide gas, which gives out a certain amount of heat. This operation goes on as long as there is carbon enough left to unite with the oxygen to produce the gas, and as the supply of carbon becomes reduced, so the ebullition of the metal, caused by the gas struggling to escape, becomes less active, and in the end entirely ceases.

When the agitation of the metal subsides, the contents must then be tapped out, or, it is said, if the iron be allowed to remain a little longer under the action of the blast, then a spongy mass of malleable iron is obtained.

The statement publicly made is that "In 30 minutes, by the foregoing process, Mr. Bessemer converts 7 cwt. of crude metal into ingots of malleable iron or steel of any size, and fit for the various manipulations ordinarily employed." He does away with puddling, hammering, rolling, and all the subsequent operations now in daily use at our iron works. He states that fine steel is produced for the engineer, and for general manufactures, and that iron so produced is equal to Swedish or Russian, now selling at from £20 to £30.

These form the leading features and pretensions of the new process, and if so desirable a result could be obtained, truly the invention would deservedly rank amongst the first, if not the very first, of the age.

I have very carefully examined those results which might be expected from an operation like the one before us, and I cannot agree with the statements made to the public by the inventor, or by those who have seen and supported both his theory and practice.

I freely admit that a *decarbonized cast iron* is obtained--that such iron is bright, white, and crystalline; but *I do not believe* that such metal will admit of being either *drawn under a hammer*, *or rolled to a bar*. I cannot admit such metal into the category of cast steel, for it cannot, in my opinion, fulfil its requirements; it will not make a boring tool, or a cutter—a tap, or a die; it cannot be fashioned by the workman's hammer, or made into a needle, or cut into a file; in fine, I am compelled to give an opinion that it is a metal which cannot assume the commercial value of steel.

At this moment, when Mr. Bessemer's progress is receiving so much of the metallurgical world's attention, particularly from those whose high attainments are generally acknowledged, it may appear somewhat presumptuous to find one strong dissentient voice; yet, from the many and very careful experiments I have made, I cannot agree with a too commonly accepted opinion—that presuming cast iron to contain 5 per cent. of carbon, and steel 1 per cent., if you deprive the crude iron of 4 per cent. of its carbon, it necessarily becomes steel. This is not the case. Mr. Bessemer's product is a decarbonized metal; the larger crystals are more decarbonized than the smaller ones, and a good lens will show that the mass is made up of small bright atoms, which are the particles least affected by the operation. The result is a metal not capable of being drawn under a hammer, or rolled to a bar; and whilst I venture to state that the process will not produce steel fit for any useful purpose, I must also add it will not produce a malleable iron suited to our wants.

I feel assured that my practical knowledge has not led me wrong in making these bold statements, which are so opposed to the generally conceived opinion. I trust they will be received in the spirit which has dictated them—not to undervalue Mr. Bessemer's exertions—but to thank him for his " mite " to that general stock of knowledge in the metallurgical art which has raised England to the elevated position she now enjoys.

On the Manufacture of Crown and Sheet Glass.[*]

(Continued from page 208.)

To return to our flattened sheets. The sheets, when annealed, are drawn from the kiln and carried to the warehouse, where they undergo examination.

Sheet glass, blown by a less complex process than crown, is liable in the glass house to a less number of defects, but after the process of flattening often makes up the deficiency; and the manner in which a sheet, spared by one process, is disfigured by another, is sometimes curiously provoking. Standing before the table of the "assorter," your eye lights upon a piece which, blown under an evil star, has imbibed in the glass-house every possible defect. The founder, skimmer, gatherer and blower, have all stamped their brand upon it. It is seedy,—the vesicles, which were in the crown tables rounded by the rotary motion of the piece, here elongated by the extension of the cylinder: it is stony,—disfigured with stony droppings from the furnace; stringy,—thin threads of glass meandering over its surface; "ambitty,"—covered with stony speckles, symptoms of incipient devitrification; conspicuous with gatherers' blisters and blisters from the pipe,—badly gathered; badly blown,—thin here, thick there, and grooved with a row of scratches; and on this abortion the flattener chances to have exerted his most exquisite skill: it has passed through his hands unscathed, flat as a polished mirror, yet, from its previous defects, entirely worthless. Next comes before you a piece whose beginning was miraculous,—no seed, no blisters: it prospered under the hands of the gatherer and blower, and left the glass house a perfect cylinder. But the croppie of the flattener marked it; the fire scalded it; dust fell upon the lagre, and dirtied it; scraps from the edges of the preceding cylinder stayed upon the lagre, and stuck to it; the stone scratched it; and the heat of the annealing chamber bent it. Such are the difficulties to which every cylinder is subject—those of the glass house, and

[*] From the Lond. Builder, No. 687.

those of the flattening kiln. Not all, however, are such as these : there are good as well as bad, but the good are generally in the minority.

The qualities range thus—best, seconds, thirds, fourths, and H, the latter standing for horticultural, and including all coarse glass, such as may be applied to horticultural purposes. The difficulty of escape from defects renders the best quality, as in crown glass, three times as costly as the common. The expense of production to the manufacturer is in each case the same; the materials, the labor, the fuel, the same for each. Success, therefore, clearly hinges on the proportion of good glass which a manufacturer can obtain. The six qualities of sheet glass may each consist of six different thicknesses, forming thus, in all, thirty-six varieties.

When this manufacture was new in England, the size usually blown was 36 inches long, and 20 wide. The usual size now is 47 inches long by 32 wide, and cylinders are occasionally blown 77 inches long, but large sizes and heavy weights are accomplished only by workmen of the first class. A sheet of this latter size, containing twenty-one ounces to the foot, would require for its formation a lump of glass upon the gatherer's pipe, of no less than 38 lbs. in weight.

The size which sheet glass can thus reach is obviously a great advantage, and adapts it to many purposes from which the limited dimensions of crown are excluded. It was this glass that covered the Great Exhibition in 1851. A cylinder was blown to cut, as the phrase is, 49 inches by 30 : this was sub-divided into three panes of 49 inches by 10. About 300,000 of these, extending over a million square feet, and weighing upwards of 400 tons, were the work of a few weeks, and this without absorbing or disturbing the ordinary produce of the manufacturer. The energy of the glaziers was equal to their task : 18,392 panes were fixed in the roof in one week, by eighty men, 108 panes being accomplished by one man in a single day.

But sheet glass has its faults as well as its virtues : it is devoid of that brilliancy of surface for which crown is so remarkable. It is subject, also, to undulations on the surface, the precise origin of which it is difficult to explain. Mr. Shaw, in his admirable lecture on the glass manufacture, as illustrated by the Great Exhibition, speaking of this defect, says, "When the divided cylinder is softened by heat, and either allowed to flatten by its own weight, or flattened by the workmen, the concave interior of the cylinder has to expand, and the convex exterior to contract, as the curved surface becomes plane. Were this contraction and expansion to take place uniformly throughout the glass, the undulation in question would not occur, but since one part invariably yields somewhat more readily than another, perfect flatness cannot be attained."

It is, however, more probable that this undulation is produced in the operation of blowing, and is due to the double movement of the particles of glass which accompanies the formation of every cylinder, the one movement being parallel to the axis of the cylinder, and the other in planes at right angles to that axis.

Having thus briefly described the two distinct processes which converge in one result, a sheet of window glass, I shall now notice the circumstances under which these two processes have attained their present position, and I shall here avail myself of the valuable information which M. Bontemps has provided.

We have no evidence whatever by which to determine the relative antiquity of these two processes. The cylindrical process is the only one mentioned by Theophilus in the thirteenth century, and this method was adopted by the Venetians, as the more uniform thickness which resulted from it insured, in their colored glasses, a greater uniformity of color. But in France, England, and the north of Germany, the cylindrical process fell gradually into disuse, as the demand for colored glass diminished, and at length in these countries the rotary principle exclusively prevailed, but it was so imperfectly carried out, that the tables seldom exceeded 30 inches in diameter, and were of very variable thickness.

Bohemia, however, still retained the cylindrical process which she had learnt from Venice, and with such success that when the French were in need of large and good glass, they imported it from Bohemia.

Thus it was until the commencement of the eighteenth century. Then a French officer, M. Drolenvaux, formed the project of introducing the Bohemian method into France. He constructed a company, brought workmen from Bohemia, and established a manufactory at Lettenbach, in 1730, with great success.

From this resulted, in France, Belgium, and the north of Holland, where the style of building required panes of large size, the abandonment of the rotary principle and the adoption of the cylindrical; and towards the close of the last century, a manufactory, near Abbeville, in Normandy, one in Hanover, and two others near Bamberg and Aschaffenburgh, were the last in which the rotary method was employed.

The last of these, that near Aschaffenburgh, was visited by a glass manufacturer in 1844, and he was much surprised at the very slow and unsystematic manner of proceeding which prevailed there. The gatherers held in their mouths a piece of pasteboard, turned up so as to protect their faces. The nose of the glass, after it had left the pipe and was attached to the ponty, was helped open with a piece of wood, and, after the table had been formed, it was laid upon a bed of small coal or coke and the ponty detached. The table was then piled in the annealing kiln.

In England, the manufacture of crown glass maintained its position, notwithstanding its abandonment abroad, and attained to such superiority over the spread or broad glass, to the rudeness of which I have alluded, that the former was used for all houses of the better class, while the latter was confined to poorer dwellings.

The inferiority of this spread glass, manufactured on the German principle, but by no means so good as the German glass, tended to prejudice the public against all glass manufactured on the cylindrical principle. This prejudice was, however, gradually overcome by the establishment in England of the manufacture of cylindrical glass, according to the process which I have already detailed, introduced from France, and from which resulted a glass which entirely displaced the manufacture of spread glass.

The introduction of this new manufacture was due to Mr. Chance and Mr. Hartley, who, on visiting, in 1830, the works of M. Bontemps, near Paris, were much struck with the advantages of the glass made on this principle, and, having secured the co-operation of M. Bontemps, they commenced the process at their own works in the autumn of 1832. So great, however, were the difficulties to be overcome, that it was not till 1838 that the manufacture of this glass was completely established. Since that time there has been great progress; and the sheet glass now manufactured in this country, though inferior in color, is in other points generally superior to that of the foreign teachers.

A further development of the sheet glass manufacture in England was the process of grinding and polishing this glass by machinery, whereby a new branch of manufacture was established, which has furnished glass peculiarly applicable for purposes of which none previously existed.

A fitting companion for this, though not within the limits of blown window glass, is the remarkable invention of Mr. Hartley, by which glass, conveyed directly from the glass pot to a table, is rolled into sheets without employing in each operation more glass than is wanted for each plate of glass, however small it may be. This glass is admirably adapted for those purposes in which translucency only is required.

The greatest stimulus, however, that has been given to the crown and sheet glass manufacture was the abolition of the duty in 1845. That abolition has produced a somewhat paradoxical result. While the quantity of glass made has increased in the proportion of three to one, the number of manufacturing firms has diminished in the proportion of one to two. In 1844 there were fourteen companies engaged in the manufacture. In 1846 and 1847, following the repeal of the duty, the number had increased to twenty-four. The glass trade, after the removal of the heavy burden imposed upon it, seemed to open a fair opening for money seeking investment. The demand for glass was so great that the manufacturers were in despair. Glass-houses sprang up like mushrooms. Joint-stock companies were established to satisfy universal craving for window panes. And what was the result? Of the four-and-twenty companies existing in the year 1847, there were left, in 1854, but ten. At this time there are but seven in the whole United Kingdom. Two, established in Ireland, have ceased to exist. In Scotland, the Dumbarton Works, once famous, were closed, in 1831, by the death of the partners, afterwards re-opened, and again closed. The seven now existing are all English.

I turn, in conclusion, from this somewhat melancholy picture to a more cheering subject, the great ends which, from small beginnings, this manufacture has accomplished. The glazier of Pompeii little dreamt that the time would come when the substance that he handled, then so rare, would minister through the world to the health and pleasure of mankind; that beneath it trees would flourish, transported from a foreign soil; and that, cheaper than wood itself, it would combine with iron to form the largest building on the earth. But from Pompeii to the Crystal Palace there has been a progress of nearly twenty centuries, and a still greater progress in action than in time. That progress has been marked by no sudden revolutions, such as have distinguished the development of other efforts of mankind. The problem of blowing glass into a sheet admits of limited solutions, a cylinder or a sphere. Through one or other of these forms the first blown sheet cannot but have passed, and through one or other all pass now. But the progress has been none the less for lack of revolutionizing discoveries. Minute and apparently unimportant changes, peceptible only to those near at hand, have in silence done their work.

Still, the development both of its processes and its applications is incomplete. Sir Joseph Paxton's glass arcade, stretching over the streets of London, and Dr. Sleigh's city of glass, in which invalids will inhale the gentle air of Madeira,—these are faint foreshadowings of the destiny of this wonderful substance.

And, perhaps, the day may come when some future chronicler of glass shall smile at the barbarians of the nineteenth century, who could not make window glass without defects, and shall exhibit those defects as curiosities of a by-gone age.

*The Gums and Resins of Commerce.** By P. L. Simmonds.

(Continued from page 183.)

Mastic is derived from the *Pistacia lentiscus*, a very common shrub in various parts of Northern Africa, where it is sought out for its resinous produce.

In the island of Chios, where the tree is cultivated for the sake of the resin as carefully as the vine, it is customary to make small incisions in the trunk and chief branches, about the end of July. From these clefts the sap, which gradually thickens, exudes; it hangs in larger or smaller drops, and when it is very abundant, trickles on the ground and dries there. It is detached from the tree by means of a very sharp instrument; often it is caught upon cloths spread under the trees, in order to prevent any soil being derived by contact with the ground.

The largest consumption of mastic is in the East, where it is universally chewed, and thence derives its name. It is asserted to be effectual in whitening the teeth, strengthening the gums, and sweetening the breath. Mastic is also used in the preparation of the finer varnishes for pictures, &c. Owing to a recent more extensive demand for France and deficient supplies, this gum has run up in price considerably, being now vended at about 1*s.* 6*d.* the ounce. As much as 1500 cwt. was formerly annually exported from Chios. Dissolved in alcohol, mastic forms a very useful cement. It is obtained in Brazil, from the *Pistacia Atlantica*, and in Beloochistan and Affghanistan from other varieties, *P. Kinjuh* and *P. Cabulica.*

Most of the Eucalyptus genus in Australia furnish gum in abundance, particularly the red, spotted, and white gum, the iron and stringy bark and other trees. It exudes both spontaneously and in larger quantities when incisions have been made in the trunk, more particularly after rain. It is seen in masses upon the trunk, but its particles have so little tenacity, that when in a concrete form any attempt to detach them in one entire lump fails, and it crumbles immediately into innumerable fragments.

This gum resin has a strong astringent quality, and is one of the varieties of the kino of commerce.

At first it is of the consistence of very thick syrup, and immediately after rain, may be seen flowing from an incision or cleft in the tree very abundantly, being then of a beautiful bright red color, becoming of a dark shining red, and hardening by exposure to the air.

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*From the Journal of the Society of Arts, Lond., November, 1855.

The *Angophora lanceolata*, or apple tree of the colonists (a genus allied to that of Eucalyptus) also yields a dark and astringent gum from its trunk and branches. A gum as fine as amber exudes from the stem of a Macra Zamia in Australia.

The Kowrie Gum of commerce is the produce of *Dammaris Australis*. For a long time it was much neglected, and the shipments made to this market did not repay the cost of its collection in the colony. The Americans, however, purchased it readily at first for £16 to £20 the ton, and it was used by them as a substitute for copal in the manufacture of varnish. From 14 to 17 tons come in annually to Liverpool, and within the last year or two it has been in greater favor in the London market, and larger supplies are coming forward. In 1851, 16½ tons were shipped from the port of Auckland, and in 1852, 107½ tons. This resin may be obtained in any quantity in the northern districts of New Zealand, ranging from twenty miles south of Auckland to the North Cape.

The Kowrie pine grows to a gigantic size. The gum resin exudes from it, and bears some resemblence to the dripping of a wax candle in the wind. It is now in demand for the manufacture of varnish and other purposes, and it is found in masses of several pounds weight. The Kowrie gum, though clearly the produce of this tree, is dug from the ground in quarters where no traces of trees now exist. The gum-diggers probe the soil with long iron spikes, and extract the gum thus indicated from generally a couple feet below the surface. These pieces of gum are probably the relics of primeval forests, which have disappeared long ago. The resin streams copiously from the stumps of the trees which have been felled, covering them with an appearance like wax, and hardening in the air.

Botany Bay Gum is a yellow resinous exudation from the *Xanthorrhœa hastilis*, and other species of the grass tree of Australia, which were generically named by Swartz, from this peculiarity. It is darker than gamboge, and less uniform in appearance, and not entirely soluble in alcohol. It has been used medicinally, to unite the edges of wounds, and in the form of tincture, with opium, in dysentery and diarrhœa, and also forms the base of a cement. This resin contains benzoic and cinnamic acid. Another species of the same family, *X. Australis*, furnishes a more brittle resin, of a brilliant dark red color, known in the colony as "black boy gum." These resins are spoken highly of as useful for varnish, and as substitutes for shellac. The grass tree is one great characteristic of the scenery and of the vegetation of Australia. It puts one in mind of a tall black native, with a spear in his hand, ornamented with a tuft of rushes. On the spear is found an excellent, clear, transparent gum, and from the lower part of the tree oozes a black gum which makes a powerful cement, used by the natives for fastening stone heads on their hammers. This gum resin may be obtained in inexhaustible quantities.

Capt. Wray, R. E., submitted a report to the local authorities of Western Australia, last year, on the manufacture of illuminating gas from the Xanthorrhœa, at one-third the expense of lighting with oil or candles.

The plant grows in abundance all over the colony, and is composed of a core of hard fibry pith, about half of its whole diameter, round which, there is a layer of resin, varying from half to one inch or more in thickness, which forms the connexion between the leaves and the core. Between these leaves, and also adhering to and covering them, is a considerable quantity of resin; resin also exudes in large lumps from the sides of the plant.

Method of obtaining the material.—In the first instance, the leaves and resin were separated from the core, by breaking up the plant with an axe, and sifting the resin from the leaves, but it was found by experience that as much gas was obtained from an equal weight of the leaves and resin together, as from the resin alone. The quantity of resin obtained from an average sized "black boy" was about 45 lbs. weight. This was collected easily, at the rate of 5 lbs. per hour, by a person having for his tools an axe and a sieve.

Should the resin be collected for export, I am satisfied that by a proper arrangement of crushers and sieves, a laborer, at 4*s.* per diem, (the colonial rate,) could collect at least one hundred weight per diem, enabling the resin to be brought to market, at Freemantle, for £4 per ton, the ton weight measuring forty-five cubic feet when pressed. The quantity of gas obtained by Capt. Wray's experiments, was at least four cubic feet to the pound of resin and leaves, but much more might be obtained by a more complete apparatus.

A cart load of the plants, 8 in number, weighed 1048 pounds. When the core was removed the leaves and resin weighed 628 pounds. This core is very good fuel when mixed with other wood. The specific gravity of the gas is 888. The products of the distillation are gas, tar, and coke. The tar obtained was about 1 quart for every 10 lbs., and this, when re-distilled, gave 8 per cent. fluid ozs. of naphtha, and 20 per cent. of a sweet spirituous non-inflammable liquor. The coke remaining was about $\frac{1}{4}$ of the original weight, and with other fuel burns well. The coke of the leaf has a bright shining appearance, and when ground with oil is a very good substitute for lamp black in paint. The gas has a smell somewhat similar to coal gas, not nearly so offensive, but sufficiently strong to make any escape immediately perceptible. Its illuminating power appears to be very superior to coal gas, and its light very white.

Captain Wray is of opinion that when the production of the gas from the resin of the Xanthorrhœa is conducted with suitable apparatus, the cost per annum will be materially reduced, so far indeed that the resin may become a large and profitable export from the colony to places which are not lit at all, or lit with oil. Among these may be enumerated Singapore, Hong Kong, Melbourne, and Adelaide.

The supply is, I may say, unlimited, and even were it not so, it would be advantageous to get rid of the plant from all the land fit for cultivation. Should, however, it be found that the plant was likely to get scarce, the resin might be obtained by tapping.

The gum resin of the New Zealand flax (*Phormium tenax*) is admirably adapted for sealing letters, and when remittances are enclosed, is frequently made use of by the colonists for that purpose. It is insoluble either in water or spirit, and so thoroughly penetrates the envelope as to become part and parcel of it, nor is it possible to get at the contents of a letter so sealed.

One of the gum trees of Popayan in Colombia yields a resin so remarkably tenaceous, that when used to varnish ornamental work, it resists the application of boiling water, or even acids, for which reason tables, cabinets, &c., made by the Indians, and lacquered with it, are highly valued at Quito.

At Copiapo a resinous gum is obtained from the branches and berries of a shrub, with a leaf like the rosemary. It is made into cakes of two feet long, by one foot thick, and is used for paying of ships, glazing the earthen jars of the country, &c.—(*Frezier's Voyage.*)

Thenethea, the produce of an undescribed plant, is used by the Burmese as a coating for umbrellas and as a varnish.

The resins of Algiers are those from the teberinthe cedar, juniper, *pinus halepensis*, of which there are large forests, *thuya articulata*, and lentiscus, alk or lek, sanderic, mastic, and pitch and tar.

In 1853, France imported over 3 million kilogrammes of resinous substances, valued at 1,844,337 francs.

SANDARAC is obtained from the *Callitris quadrivalvis*, Rich., the *Thuya articulata*, Whal. This tree furnishes the highly prized citrus wood of the ancient Romans; and the Thuya wood of Algeria has recently again come into high repute among the French cabinet-makers. Experiments for cultivating it on a large scale are now being carried out in the French African provinces.

It should be remarked that under the generic name of Thuya, various coniferous trees furnishing resin are confounded in Algeria. Sandarac is used in the preparation of varnish, and also for making pounce.

At the Paris Exhibition a light and transparent hard resin, from Coorg, was shown, of which I have a specimen on the table. It is said to be soluble in spirit, and suited for coach varnish, but Mr. Wallis does not speak well of it. The piney varnish of the *Vateria Indica*, is a kind of dammer, which is too soft for general purposes. An Assam resin, unnamed, is also a species of dammer, on which spirits of wine has little or no action.

The Gaub tree resin from Beerpoor is a very dark amber color, which melts lighter in color by heat, and mixes with oil. There is also a more transparent lighter variety shown from Calcutta.

According to my correspondent, Mr. Ondaatje, a black resin is produced by a tree growing in the more barren parts of the district of Ceylon, in which he resides (Badulla), and belonging to the Anacardiaceæ, a tribe of plants which abounds in black resinous juice, whence the black varnishes used in China and India are obtained. It would seem to be the *Semecarpus obovatum.* From natural fissures of the bark, there runs out a clammy juice, which, at first white, becomes afterwards black by exposure to the sun's rays, hardening into masses of different sizes with pieces adhering. The resin is hard, breaks with a smooth shining fracture, burns with a bright flame, melts in fire, and is soluble in turpentine, insoluble in water, and adheres strongly to wood and metal. It is free from acridity. It forms a superior black varnish when added to a saturated solution of vateria resin, or East Indian copal, in oil of turpentine.

Two specimens of Ceylon resin, which I have here from the Paris collection, are merely species of dammer.

(To be Continued.)

For the Journal of the Franklin Institute

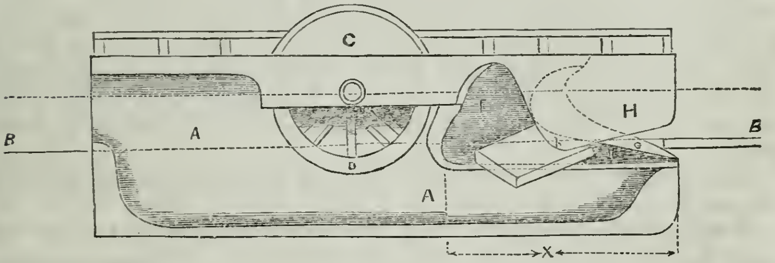
Description of H. & W. Brown's Ice Boat.—Patent granted August 5th, 1856. H. Howson, Civ. Eng.

This invention consists in constructing a steamboat with a recess at the bows, the bottom of the recess consisting of two inclined shelves, one on each side, and divided by an angular rib tapering upwards from the bows, and terminating with a curve on the deck, the end of the recess forming an angle, the sides of which taper towards the bows of the boat. In connexion with the above, is employed a guard on each side suspended from and secured to the deck. The whole is arranged and constructed as fully described hereafter, for the purpose of breaking the ice, and directing the broken pieces under the body of the ice which remains unbroken on each side of the boat, thus forming a clear channel in frozen rivers and harbors, for the passage of sailing and other vessels.

On referring to the accompanying engravings—

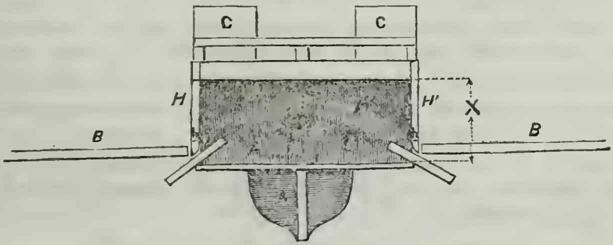
Fig. 1. is a side view of the ice boat.
Fig. 2. an end view looking towards the bows.
Fig. 3. a sectional plan on the line 1—2 (Fig. 1).

FIG. 1.



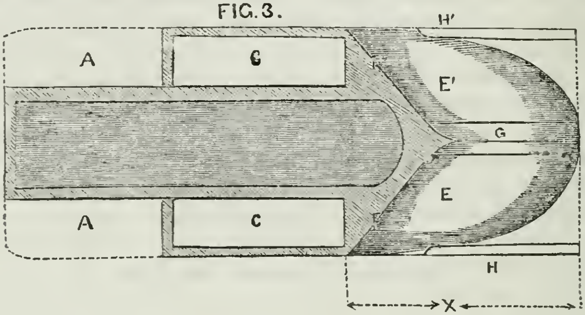
A is the hull of the boat; B, the water line; C, the boxes in which work the paddle wheels D, the latter being of the ordinary construction.

FIG. 2.



In the bows of the boat is constructed a recess X, the bottom of which consists of two shelves E and E', the distance between the outside edges of which at their greatest width, and viewed transversely as in Fig. 2, is the same as, or somewhat greater than, the distance between the outsides of the two paddle wheels. The edges of the opposite shelves viewed as in Fig 3, taper with a gentle curve towards a blunt point at the bows, where they meet each other. From their edges the shelves taper upwards with a rounded curve longitudinally towards the termination F and F' of the recess, as well as laterally towards the angular projecting rib G, which separates the two shelves. This pointed rib at the bows projects slightly above the shelves, but increases in depth as it tapers upwards, and terminates with a curve at the underside of the deck (see Fig. 1). The terminations F and F' of the recess which meet the shelves E and E', taper towards the bows of the vessel, as seen in Fig. 3.

FIG. 3.



Suspended from the deck of the vessel, and firmly secured thereto on each side of the bows, are the guards H and H', the points *h*, of which project a short distance below the water line. From these points the guards taper both ways, being beveled on the inside. It should be understood that the edges of the shelves E, E', must be from 12 to 18 inches below the level of the water line B, so as to pass under ice of reasonable thickness.

Supposing the above described boat to be propelled towards a cake of ice, the first portion that comes in contact with the latter, will be the tapering point of the angular rib G; the further progress of the boat will cause the rib to so act on the underside of the ice, as to raise and consequently split the same as the boat continues to advance. The guards H and H', will also have a tendency to break the ice at the point where their beveled edges come in contact with the latter. Thus the ice will for the most part be broken into square blocks, which must necessarily fall on each side of the projecting rib G, and on to the inclined sufaces of the shelves E and E', as the boat continues to advance; the shape of the shelves will direct the blocks under the ice on each side of the vessel as seen in Fig. 2, and such an impetus is given to the broken pieces by the angular terminations F and F', of the recess, that they are forced a considerable distance under the remaining ice, and thus by the propulsion of the boat, a clearer channel is cut than by the usual process of breaking up the ice into small pieces by striking the same by the bows of vessels and the action of paddle wheels.

The claim appended to the specification, is for the formation of a recess in the bows of a steamboat, said recess having inclined shelves, E and E′, angular terminations, F and F′, and angular rib, G, in combination with the guards, H and H′, the whole being arranged and constructed substantially in the manner herein set forth, and for the purpose of breaking a channel through ice, and directing the broken pieces under the ice remaining on each side of the channel.

On the Manufacture of Iron and Steel by Bessemer's Process.[*]

To the Editor of the Mining Journal.

Sir,—In your Journal of the 16th is reported a paper, read before the British Association at Cheltenham by Mr. Bessemer, on the "Manufacture of Iron and Steel." In calling attention to the subject, I have no desire to question the value of the invention, which is almost illimitable, but as, in reading your report, the public will imbibe the false impression that Mr. Bessemer is the original patentee of the application of the principles involved in the process he describes for treating crude iron, I think it only just to those interested in the manufacture of iron, to Mr. Bessemer himself, and, above all, to my client, to remark that a patent which I obtained on behalf of Mr. J. G. Martien, of Newark, U. S., dated Sept. 15, 1855 (and noticed in the *Mining Journal* a few months ago), for "Improvements in the Manufacture of Iron and Steel," will prevent the use of Mr. Bessemer's patent, unless license be obtained from Mr. Martien, for whom I claim the honor of first inventor and patentee of the process of treating crude iron—the subjecting it to the direct agency of, and disseminating through and amongst it, atmospheric air under pressure, as it flows from, or after it has flowed from, a blast furnace, and prior to congelation, as described by Mr. Bessemer.

I trust you will see the justice of giving this claim all the publicity possible, in order to correct the false and prejudicial impressions which will otherwise exist on this important subject.

John Avery, Patent Agent, 32 Essex Street, Strand.

Paris, *Aug.* 19.

P. S. It may be well to mention that Mr. Martien has publicly proved his invention in Britain, prior to the date of Mr. Bessemer's patent.—J. A.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, September 18th, 1856.

B. Howard Rand, President, pro tem.
Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

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[*] From the London Mining Journal, No. 1047.

Letters were read from the Commissioners of Patents, London, Eng.; and J. Franklin Reigart, Lancaster, Pennsylvania.

Donations to the Library were presented from Mr. John Hereges, Nashville, Tenn.; J. S. Losing, Esq., Boston, Mass.; Messrs. Appleton & Co., City of New York ; J. Franklin Reigart, Esq., Lancaster, Pennsylvania; George M. Conarroe, Esq., and Prof. John F. Frazer, Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of August.

The Board of Managers and Standing Committees reported their minutes.

Candidates for membership in the Institute (17) were proposed, and the candidates proposed at the last meeting (5) were duly elected.

W. Jones exhibited a "Summator," an instrument designed to perform the addition of numbers. It consists of a circular card, upon which the numerals from 1 up to 100, are printed at the points of intersection of a spiral line with a number of radial lines (on the instruments shown them were one hundred of the latter), the figures increasing in amount as they approach towards the centre of the card. The card is hung by a central pin to and behind a light circular plate of wood, which hides all of it except a portion which is visible through a horizontal slot, extending from the circumference towards the centre. Upon the outer edge of this plate, figures from 1 to 100 are printed in legible characters, the tens, twenties, thirties, &c., being connected in groups by strong lines, and printed in dark characters to give greater facilities in finding any desired number. Surrounding the plate is a ring of wood, which is attached to the card, and moves with it around the centre-pin ; in its periphery are one hundred indentations, corresponding with the number of the radial lines, and with the figures printed around the edge of the plate. A small index slides in the slot of the plate, its motion being coincident with that of the spiral line on the card over which it always is, approaching to, or receding from the centre, as the card is turned from right to left, or *vice versa.*

The operation of adding is performed thus :—The index is placed at zero by turning the card backwards by means of a crank handle intended for that purpose ; the indentation over the figure equalling the amount of the bottom line of the column to be added is brought by the revolution of the ring and card just opposite the slot in the circular plate, at which point it is arrested by a stop, against which the finger or pencil used to rotate the ring strikes, when the index will have moved towards the centre, and will mark the amount of the first line of the column to be added. The amount of the next line being taken, and the ring turned, the number shown by indicator will equal the amount of the first and second lines, and so on. To those persons who are not expert in adding, and do not care to become so, this instrument will no doubt be useful. It is mounted on a neat stand, and is a much more convenient and rapid way of adding mechanically, than the old way of slipping balls upon wires stretched in a frame, and which no doubt is familiar to all.

COMMITTEE ON SCIENCE AND THE ARTS.

Pneumatic Rotary Governor.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination the "Pneumatic Rotary Governor," invented by Mr. John Tremper, of Philadelphia, Pennsylvania—

REPORT:

That it consists of a spindle, supported in an upright position by bearings in which it is free to revolve as in ordinary governors. Upon this spindle is fitted loosely, a hub having four equally disposed radial arms, which carry near their extremities a disk of metal, capable of being moved from or towards the spindle, and fixed at the required distance by set screws, their plane surfaces being always parallel with the axial line of the spindle. Attached to the upper end of the spindle, at opposite points, are two flexible chains, which are connected with two opposite disks, and serve to suspend the hub and its attached parts. From the points of connexion for the necessary distance downwards, the spindle tapers at a rate determined by the shortening of the chains as they wind upon it when the governor is in motion.

The hub is connected by the usual appliances with a balanced throttle valve.

The belt passing over a small pulley upon the spindle, gives it a high rotative velocity, so that any small variation in the speed of the main shaft will be sensibly increased in that of the spindle.

OPERATION—When revolution is given to the spindle, the chains wind around its taper part, causing the hub to raise and revolve, (but at a less rate than the spindle,) until their tension, increasing as they approach towards a horizontal line, just equals the opposition to rotary motion made up of the inertia of the hub with its parts, and the resistance of the atmosphere to the plane surfaces of the disks, when, the spindle and the hub will have a common velocity. If the speed of the main shaft be made slightly greater, the variation is multiplied on the spindle, while the resistance of the disks prevent them from partaking in the faster speed, until the chains have wound around the spindle, drawing up the hub and increasing their tension sufficiently to equal the additional resistance due to the greater rotative velocity.

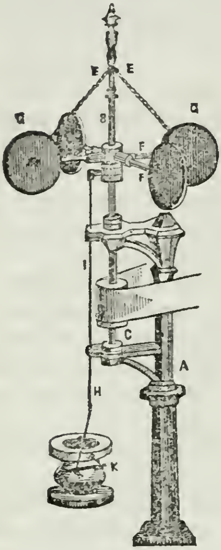
When the speed of the main shaft is diminished, the movements are reversed, the chains unwinding, and the hub falling by gravity.

The Committee entertain a very favorable opinion of this governor. It is simple in construction, almost frictionless from the absence of rubbing surfaces and joints, extremely sensitive and prompt in its action, graduating as nearly as possible the admission of steam to the work to be done by the engine.

By order of the Committee,

Philadelphia, May 8, 1856. WILLIAM HAMILTON, *Actuary.*

Description by the Inventor.



A is an iron pillar, with two offsets or projections. B is an upright spindle or shaft of the governor, resting in the lower projection, and passing through the upper one. D is a hub which works vertically upon the upright spindle or shaft B. The arms F F are cast in the hub, making the whole solid. On the arms are screwed four disks, C C, answering the double purpose of weights and fans. E E are chains extending from the fans to the top of the spindle, and secured by hooks or pins by which the disks and hub is suspended, the top of the spindle being conical as far as the chains wind down. The governor receives its motion from a belt running over pulley C. When the governor is put in motion, the chains E E will wind around the conical spindle B, and raise the hub o, until the fans have acquired a common velocity with the spindle. The hub and fans being free from the spindle, their motion will be opposed by the joint action of their inertia and the resistance of the atmosphere, the magnitude of which determines the distance the hub is raised, which is connected to the throttle valve K, by the rod H, as shown. If the speed of the spindle is increased, the chains will wind more around the spindle and thereby shorten them without increasing the motion of the fans in a corresponding degree, on account of the atmospheric resistance increasing as the square of the velocity of the body moving through it. Again, if the spindle is decreased, then the weights or fans by their momentum will run faster than the spindle, and thereby slacken the chains, which allows them to descend and act upon the throttle valve as before. It may be observed here, that the instant the chains slacken, the fans and hub will begin to descend, and they will fall as rapidly when in motion as when at rest. Hence, the beautiful principle involved in this governor, and one of the most important features in its action. In the old fly-ball governor, the weight of the balls, or their power to act upon the valves, varies with their speed, the power diminishing as the speed is increased; and since all throttle-valves work more or less hard, the governor must alter in a corresponding degree to acquire sufficient power to produce the necessary changes. Again, the great variation of angle in which the balls describe from the spindle, allows a large variation in the engine between the opening and closing of the throttle-valve. With this governor the whole weight of the fans and hub is brought to act on the valve the instant the speed varies, and may have any variation of rise desired, and may be driven at any speed, and each one made more or less sensitive, as desired, being unlimited in its mode of construction and action.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

NOVEMBER, 1856.

CIVIL ENGINEERING.

For the Journal of the Franklin Institute.

Description of a Metallic Spring for Cars, Carriages, &c. Invented by LEVI BISSELL, of the City of New York, and patented February 20th, 1855; ante-dated August 24th, 1854.

The nature of my improvement consists in the employment of a thin metallic strap, in combination with a metallic bar, rigidly attached together at each end, and so arranged that the thrust of the car on the spring, shall tend to elongate the metallic strap; the elastic force rendered available is the tendency of the thin metallic strap to retain its length and form in opposition to tensile strain.

Plate 1. Fig. 1, is a side view of the spring attached to a car truck.
Fig. 2, is a side view of the spring detached.
Fig. 3, is a top view of the spring.

A B (Fig. 2.) is a rigid metallic bar of sufficient strength to prevent its bending. It may be made of wrought or cast iron or steel, and in ordinary passenger cars, it should be about two inches square in section. It should be long enough to extend from the journal of one axle to the journal of the next axle on the same truck as shown at A B, Fig. 1.

To the extremities of A and B of this rigid bar, a metallic strap of wrought iron, C D, is rigidly attached. This metallic strap, C D, is made of wrought iron about $\frac{3}{4}$-inch thick, (varied of course according to the degree of pressure to be resisted,) and about three inches wide.

The metallic strap C D, is attached to the extremities A and B of the rigid bar, either by hooking and rivets, as shown in Fig 2, or by welding.

M N is an upright metallic support or bracket, and is shaped as shown in Fig. 4. It is flat on top and has a pin which passes across and rests at H, upon the middle of the strap C D. This bracket is to receive the vertical pressure and transfer it to the metallic strap C D. The compound spring thus formed is attached and operates as follows: the body of the truck frame on each side rests upon the top of the brackets M N, as shown at Fig 1.

The extremities A and B, respectively rest upon the top of the boxes of two contiguous axles, as shown in Fig. 1. When the truck is attached to the car, the weight of the car presses upon the bracket M N, in the direction of the arrow, and as the extremities A and B, are supported by the journals of the axles, the metallic strap C D tends to recede from the rigid bar A B at the point H. The strap C D can only recede by increasing its length.

Instead of a single thin strap, a series of two or more straps may be used.

The principle on which my spring depends for its efficiency is the tensile elasticity of the thin metallic strap when applied in this manner.

What I claim is the combination of the rigid bar and the thin metallic strap, with their extremities rigidly attached together in the manner described.

Experiments with L. Bissell's Metallic Springs.

At the request of Mr. Levi Bissell, I attended, on Thursday, February 21st, a series of experiments upon several car springs of the forms and dimensions exhibited in the sketches hereto annexed, marked 5, 6 and 7.

Fig. 5, consisted of a central horizontal bar *e*, of wrought iron, with the upper and lower pieces, *a*, *b*, *c*, and *d*, attached together by joints at each of their extremities, as shown in the drawing.

This spring, so constructed, was placed under a testing machine and submitted to a pressure of 1000 pounds; this pressure was increased to 5000 pounds, under which weight the spring vibrated freely and retained its elasticity entirely.

Fig. 6, consisted of two pieces *f* and *g*, attached to the centre bar *e*, precisely like the centre bar *e* in Fig. 5. This form of spring was submitted to a pressure of 7800 pounds, and vibrated freely under that pressure, preserving its elasticity entirely. It vibrated about 60 times per minute with 3000 pounds, and it vibrated 48 times per minute under 5000 pounds. This size and form of spring as ordinarily used, was said by Mr. Baldwin to support 4000 pounds weight—although its elasticity did not appear to be affected by the weight of 7800 pounds. The elongation and contraction of centre bar *e*, with 7800 pounds, was between $\frac{1}{32}$d and $\frac{1}{16}$th of an inch.

Fig. 7, was of the same material, form, and dimensions as Fig. 6, except that the centre bar *e* was cut off at *xx* and *xx'*.

This form was submitted to a weight of 1000 pounds, when it vibrated slightly. Under 3000 pounds it set permanently and ceased to vibrate, and when this weight was removed the diameter *l*, *m*, (Fig. 7) had diminished $\frac{3}{4}$-of an inch from what it was at the commencement, showing a permanent change of form of spring under that pressure (3000 lbs).

No permanent change took place in the diameter l, m, Fig. 6, under 7800 pounds, which was the amount placed on it.

Although disposed to doubt the fact at first, these experiments convinced me that the available elasticity of spring Fig. 6, is due mainly to the longitudinal elasticity of the centre bar and to the longitudinal elasticity of bars f and g, and is due only in a limited degree to the rigidity of form dependent on the arrangement of the pieces f and g.

I also saw these springs attached to a locomotive tender, at Mr. Baldwin's factory. I am under the impression that springs so constructed, render available the longitudinal elasticity of the iron, and that this is the essential feature of their action, and that they constitute a valuable improvement in the arts.

John F. Frazer.

Description of the Drainage of the Haarlem Mere.[*]

There is no land which, like the western districts of the Netherlands, called North and South Holland, has to use such means for defending itself from the sea, whose impetuous waves at many times threaten to recover the ground which, by the unremitting labor of men, has, pace by pace, been conquered by them. For a stranger not accustomed to this aspect, it must be most astonishing to see the laborer peaceably cultivating the rich soil, and the fine cattle covering the mild pastures, when he is informed that at the time of high spring-tides, with the wind blowing hard, on the giving way of the barrier defending the country from the sea, some of the lowest lands would be covered with a depth of water of no less than 7·90 met. (about 26 feet). The greatest part of these lands have, by art, been changed from stagnant pools and marshy grounds into the most precious lands, the position of which, however, necessitates a constant application of artificial means to keep them dry. An idea may be formed of the extensive drainage works performed in the two above-named districts, from the statement that since the year 1440 until the present time no less than 107,490 hectares (261,123 acres) have been converted into magnificent land. These lands requiring a good discharge for their surface water, the districts have been divided into under districts, which, though subjected to Government, have the direction of their own waterways, for their maintenance in good order, and, generally, to watch over their interest. Such an under district is called *Waterschap*, which has often a great extension. These under districits contain one or more reservoirs, natural or artificial, being their catch-water, or so-called *boezem.* These *boezems* have to fulfil different duties, one of the greatest being to collect the superfluous water during high tide, and discharge it when the level of the sea or river into which it is to be discharged has fallen enough for this purpose. Also, in very dry summers, they are to retain a sufficient quantity of soft water for the fields and pastures, and for the communication by water. The higher lands discharge their water into these *boezems* by lying on a higher level; the lower lands, which are separated from them by dykes, discharge their superfluous water by artificial means into these *boezems*, which communicate with the sea or adjacent rivers by sluice-gates.

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[*] From the Lond. Artizan, June, 1856.

The under district or *Waterschap*, in which is the late Haarlem Mere, is called *Ryhnland*, having an area of 123,500 hectares (305,185 acres), of which, before the drainage of the mere, 22,700 hectares (56,095 acres) were *boezem*, 30,740 hectares (75,962 acres) high lands, and 70,060 hectares (173,128 acres) lands which are artificially kept dry.* The accompanying map† represents this district as it is, confined on the north side by the Y, being a branch of the inland sea, called the *Zuider Zee*, on the west by the North Sea, on the south by the under districts or *Waterschappen*, *Delfland*, and *Schieland*, and on the east side by high lands.

It is enclosed, almost totally, by embankments; the defence against the North Sea, however, consisting chiefly in natural downs, though, in some points, as these were wanting, the defence had to be completed by artificial embankments, requiring an unremitting care and heavy expense. The means of discharge of *Rhynland* are confined to three points—viz: one on the Y at *Spaarndam*, by four sluice-gates, having a collective breadth of 23·96 met. (78 ft. 7½ in.), and at *Halfweg* by three sluice-gates, having a collective breadth of 17·61 met. (57 ft. 9½ in.); two on the North Sea at *Katwyk*, by a sluice-gate, with three apertures, having a collective breadth of 16·95 met. (55 ft. 7½ in.); and three on the river *Yssel* at Gouda, by three sluice-gates, measuring together 19·10 met. (62 ft. 8 in.). The *Yssel* discharges itself into the river *Maas*, which falls into the North Sea. On inspecting the map, it will be readily observed that by the situation of the points of discharge, this district has almost always the facility of discharging its surface water, for when heavy winds from the west and south-west drive the water to the coast along the North Sea, the water on the north coast, on the contrary, is driven away. When, on the contrary, the water of the Y is being sent up by heavy easterly winds it is driven from the coast of the North Sea, whereby the sluice-gates at *Katwyk* draw off the water, though the *boezem* in this case is not lowered so much in the same time as by the discharge on the Y, owing to the lesser breadth of the sluice-gates and the longer and more tortuous way by which the water has to go. The sluice-gates at Gouda discharge very little water, owing to the gradual rising of the river bed.

After these preliminary remarks, which were necessary to a proper understanding of this subject, we may proceed to describe the different works executed to drain the Haarlem Mere.

This mere, lying on the north side of *Rhynland*, had not always the great extent which it had at the time of its drainage. The earliest existing map informs us that in the year 1531 there existed no more than four little meres, that there were different roads, and three villages, which at the time of the drainage being commenced had been swept away, and the surface covered with water. These four meres, of which the position is shown on the map by dotted lines, had, perhaps, no greater surface than about 6000 hectares. In the year 1591, one of the villages had already disappeared, and the four meres had extended to a single

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* Of these high lands, 11,400 hectares are sand hills or downs, being a natural barrier aginst the sea, so that 19,340 hectares only (47,790 acres) are cultivated.

† This map will be given in our next.—Ed.

Levi Bissell's Spring.

Fig. 1.

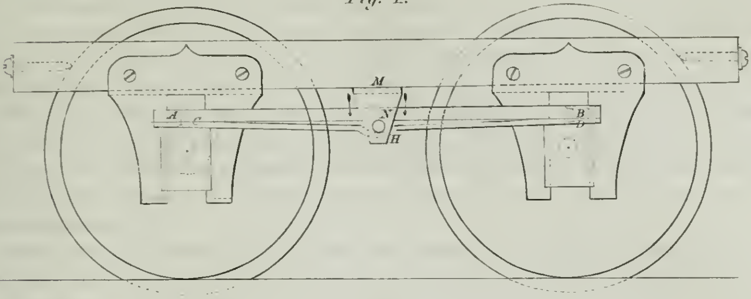


Fig. 4.

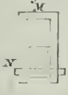


Fig. 2.

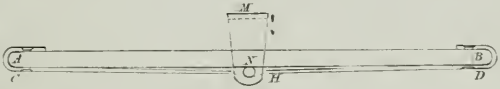


Fig. 3.

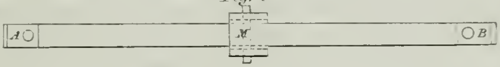


Fig. 5.

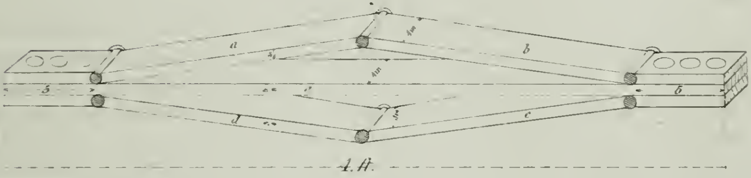


Fig. 6.

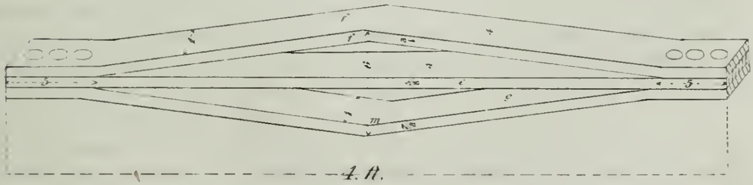
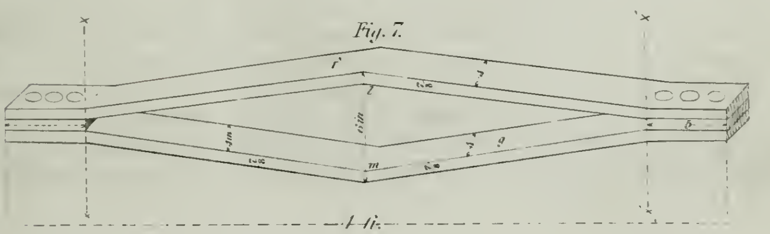


Fig. 7.



one. In 1647 the two other villages were drowned, and the (until then not existing) *Kager Mere* on the south side was formed ; the mere at that time covered an area not much less than at the time of its drainage. The mere extending itself more and more, necessitated incessant renewals of the works constructed to limit its further extension, and the construction of new ones ; even so that during many consecutive years no less than from 30,000 to 40,000 florins (£2500 to £3300) had to be expended. It was now more to be feared that the mere would unite with the smaller meres adjacent to the east side, which would have been a calamity of which the consequences would have been of the most frightful character.

As early as the year 1617, a plan was formed to drain the lake, which was renewed in 1631, but without any success. In 1643 a talented millwright, named Leeghwater, having very successfully performed many operations of this nature, produced an elaborate plan for the drainage of the Haarlem Mere, to be executed by surrounding the mere by an embankment, on the outside of which is to be formed a channel for the purpose of isolating the waters of the mere from those of the surrounding country, and conveying them to the existing points of discharge. The draining was to be performed by 160 wind-mills, in four rows, each lower row bringing the water to a higher one, which again lifted it to the third row, by which it was to be raised to the fourth, discharging it finally in the channel. The enclosure was to cover an area of 17,000 hectares (42,000 acres), the probable cost being calculated at 3,690,000 florins (£307,333). This plan exhibits much ingenuity, and was the basis on which the great number of subsequent plans were formed. No less than fifteen different plans, more or less practicable, were formed in the two centuries since the first great plan of Leeghwater was published, succeeding each other at smaller intervals, according to the greater extension of the lake, until, in 1836, the heavy storms in November and December decided the fate of the lake. On the 29th of November of this year a heavy storm, blowing from the west, swept the waters under the walls of Amsterdam ; while on the 25th of December, by a violent storm from the east, the waters inundated an immense tract of land on the side of Leyden, while even a portion of that city was drowned by the irresistible waves. Many of the lower lands then inundated, remained in this position during more than a year. This fixed once more the attention on the necessity of the drainage of the mere ; even so that in August, 1837, by a royal decree, a commission was assigned to examine the then existing plans of drainage, and to report on it before November of the same year.

This commission had finished its task as early as the end of October, and offered its report, of which the principal points were as follow :—

The discharge of the water from the mere should take place on the *boezem* of *Rhynland*, for if the water should be discharged on the Y and the North Sea by particular channels, it would involve almost insurmountable difficulties. The *Spiering Mere* (shown on the map, on the north side of the mere) should not be drained, but reserved as catchwater, for assisting the discharge by the sluices at *Halfweg*, to which a fourth was to be added, for the wind, blowing on a great surface before the sluice-gates, assists considerably in urging the discharge of water, which is not the case in a narrow canal, which, besides, has the disadvantage of occasioning a great difference of level at different points. One of the first points of consideration was the care for a ready discharge, which was the more necessary, as while, by draining the Haarlem Mere, the *boezem* of *Rhynland* should be reduced to about one-fourth ; therefore, it was recommended by the commission to improve the sluice-gates at *Katwyk*, and to widen its canal leading to the mere. Moreover, they proposed improving and deepening the river *Spaarne* (shown on the map), and erecting a steam engine at Spaarndam of 180 H. P., with a sluice-gate for discharging its water. This engine had to raise the water on the Y at the time of high winds or high tides impeding a natural discharge. The lake had to be enclosed by an embankment, which, again, was surrounded by a canal, serving as an outfall for the waters to be raised, and, at the same time, being of such a capacity as to offer ample facilities to the navigation. This embankment was to have a length of 49 kilometers (30·44 miles) ; the canal to have a breadth of from 35 to 40 met. (115 to 130 ft.), and a depth of 3 met. (10 ft.). The commission proposed to drain the lake by wind-mills, with auxiliary steam power. They recommended two rows of 32 mills (actuating Archimedean screws) and three rows of five mills each (actuating inclined flash-wheels), so that the total number of mills should amount to 79. Moreover, they proposed the erection of three steam engines of 40 H. P., each (actuating Archimedean screws), to be placed each in the neighborhood of one of the points of discharge. They valued the cost at 8,355,000 florins (£400,000, nearly), besides 400,000 florins (£33,000) for unprovided works.

Many difficulties and obstacles had to be surmounted before the execution of such an enterprise was finally fixed ; and it was not until the 22d of March, 1839, that a royal decree was passed, ordering the drainage of the Haarlem Mere to be executed by the Government in the manner of all public works, and that the plan of 1837 should be followed, save any alterations to be fixed afterwards.

A commission was appointed for superintending the works, composed of eleven members, of high standing in society, and of scientific attainments, being partly Members of Parliament and partly Royal Engineers. After some alterations, this commission finally consisted of thirteen members, of which Mr. D. F. Geversran Endegeest, was elected as chairman. Afterwards two Royal Engineers, Messrs. P. Kock and J. A. Bijerinck, were appointed for the execution of the works, the task being a most difficult one, but one which they have executed in the most laudable manner.

It being determined that this gigantic work should be undertaken, notwithstanding the many claims from different sides, arising from ignorance or ill will, and which are called forth by every great enterprise, the commission began its heavy task with great vigor and courage. Many alterations were made in the previous plan, and when at last the final plan was issued, it contained the following leading points :—

The drainage of the entire mere (including the *Spiering* and *Kager Meres*), covering a surface of 18,100 hectares (44,727 acres), and having a mean depth of 4 met. (about 13 ft.)

Surrounding the mere by a continued embankment, having a length of 59·5 kilomet. (37·5 miles nearly), of which a length of 2780 met. (9120 ft.) had to be formed through the water.

The formation of a large canal for the discharge of the water and the navigation, which, besides, had to receive all the water previously discharged into the mere; the formation of embankments wherever the canal happened to intersect low lands, for isolating these lands from the canal; constructing bridges over the canal for the communication with the lands to be afterwards reclaimed from the mere.

The discharging of the water to be raised by means of the above named canal on the *boezem* of *Rhynland*.

To provide by adequate means for the discharge of this *boezem*, which was considerably to be reduced by the drainage of the mere, and which, without such means, would rise to too high a level. This had to be effected—1st, by improving the outfall at *Katwyk*; 2d, by widening and deepening the river *Spaarne*; 3d, by erecting a steam engine of at least 180 H. P. at *Spaarndam* for raising the water from the *boezem* on the Y when the natural discharge should happen to be interrupted by some cause or other; 4th, by constructing a fourth sluice-gate at *Halfweg*.

Providing the means for furnishing soft water in very dry summers, it being proposed to attain the same by making a communication with the river *Yssel*.

Constructing different works for the use of the navigation, and compensating for the greater distance which ships had to go by following the intercepting canal.

Providing means for compensating the loss arising by the drainage of the mere to the system of defence of Amsterdam by inundation.

The division of the mere after the drainage; the forming of canals; construction of roads and bridges.

Such were the leading points of the plan to be followed in draining the mere, and according to which the drainage has been performed.

We will subsequently describe the different works in the order in which they have been executed.

Before anything could be done, the commission had to obtain possession of the different grounds adjacent to the mere, and necessary to the execution of the works. This has been executed without much difficulty on the part of the proprietors, who have generally transferred them for reasonable prices, the total expense having been 706,373 fl. (£58,880). Being in possession of these grounds, the first thing to be done was the providing means for a good discharge of the waters. It was resolved to begin by improving the waterway from the mere to the sluice-gates at *Katwyk*, which was very tortuous and narrow, the greatest part being a small existing stream, and a small part, nearest to the sluice-gates being made by art, but of too small a capacity. It was resolved to rectify the stream and to give it the necessary capacity, as also to enlarge the existing canal. The new canal has a length of 4235 met. (4631 yards), the breadth at the surface being 40 met. (131 ft.); breadth at bottom, 31·20 met. (102 ft.); average depth, 2·20 met. (7 ft. 2½ in.) The cost has been 33·05 fl. per running met. (£2 13s. 7·8d. per yard). Three bridges had to be constructed on this new canal, and two bridges on the existing canal had to be lengthened in consequence of its enlargement, which took place a short time afterwards. Lastly, the three existing sluice-gates had to be augmented by two new ones, so that their total width was augmented to 23·73 met. (77 ft. 10 in.) By these works a spacious outfall for the waters on the North Sea was provided for, while, in the meanwhile, works were undertaken to insure a good discharge of the superfluous water on the Y; therefore a great number of shoals in the river *Spaarne* had to be removed, while at the same time a towing path was constructed along this river from the mere to *Spaarndam.* Before the drainage of the mere could begin, all the works for the discharge of the water had to be finished, and accordingly the steam engine at *Spaarndam* had to be erected before the total enclosure of the lake could be performed. After many considerations it was determined that this steam engine should be placed at any distance from the sluice, in the great embankment separating the river from the Y, and that a short canal should be formed for the communication of the engine with the sluice-gate. The position of the engine and the different gates is represented in the adjoining sketch (Fig. 1), which needs no explanation. The engine is double-acting, with horizontal cylinder and is condensing. The steam-cylinder has a diameter of 1·52 met. (60 in.), with a stroke of 3·04 met. (10 ft.) Four boilers, with internal flues, having a diameter of 1·65 met. (5 ft. 5 in.), and a length of 11·50 met. (37 ft. 1 in.), furnish steam to the engine, which moves five flash-wheels on each side.

These wheels, having a collective breadth of 22 met. (72 ft. 2 in.), can be moved together, or any number may be moved, according to the height to which the water has to be raised.

Experiments made with this engine have proved that the difference of level of the water being about 1 met. (3 ft. 3 in.), with only four wheels, having a collective breadth of 10 met. (32 ft. 10 in.), the volume of water raised was 843 cubic met. (29,771 cubic ft.), or 84·3 cubic met. (2977 cubic ft.) per minute for each metre in breadth of the wheels. Different circumstances and difficulties delayed the erection of this engine, which was constructed by Messrs. Dixon & Co., at Amsterdam, though it was finished long enough before the drainage of the mere was commenced. On the 26th of November, 1846, it entered on regular service, and since that time until the completion of the drainage of the lake in July, 1852, it has raised from the *boezem* of *Rhynland*, on the Y, no less than 923 million cubic met. (1207 million cubic yards) of water in about 13,000 working hours, or nearly one million cubic met. more than the three powerful engines for emptying the lake discharged on this *boezem.* This is a proof of the great boon this engine is to the district, for when the *boezem* threatens to rise to too high a level, by the combined action of the three engines, and of 261 wind-mills discharging the surface water of the surrounding country on the same *boezem*, already considerably reduced, when the Y happens to be at too high a level for natural discharge, the discharge is, nevertheless, accomplished. The gate has two sluices, measuring together 14 met. (46 ft.), and is so constructed that ready means are provided to inundate the adjacent country, in case of need, for the defence of the capital.

During the construction of these works, which regarded but the improvement of the discharge of the *boezem*, the works for the drainage were duly undertaken, commencing with the enclosure of the lake. The embankment and the surrounding canal had to be formed simultaneously, for the ground arising from the formation of the canal had to be used for the formation of the embankment. It was determined to follow the course of the banks, save in those places where the angles should be too great, so that at those points the embankment had to be constructed in the water.

(To be Continued.)

Description of an Improved Construction of Crossing.[*]

By Henry Woodhouse.

In the Crossings used in the permanent way of railways, an important portion of the expense of maintenance arises from the wear of the wing rails, caused by the wheels wearing a groove or recess on the upper surface of each wing rail at the part where they first strike it, when they lose the support of the main rail at the point of the crossing. The effect of this wear is to cause a drop of each wheel in passing over the crossing, producing a violent blow, and leading to more rapid destruction of the wing rails, which require to be taken up and renewed, when worn into a groove at that part; the necessity for renewal occurs frequently in a short time, in situations where a heavy traffic passes over.

The object of the improved construction of crossing, described in the present paper, is to reduce the expense of these repairs, by constructing the rails of the crossings in such a manner, that when the wing rail is worn out at the part exposed to wear, it may be reversed, and the worn part replaced by another portion of the same rail; and also by making the check rails of the same form and length as the wing rails, so that when the latter are thoroughly worn out as wing rails, they can be used as check rails—what were previously the check rails being now used as wing rails.

When the crossing has been some time in use, supposing, as is generally the case, that the traffic is mainly in one direction, one of the wing rails becomes injured by the action of the outer portion of the wheel tyres at a given point,—when it is so much worn at that part as to require replacing, it is taken up and turned end over so as to bring the lower side uppermost. The crossing can now be used again till the part most exposed is worn out: the other wing rail is then substituted for the one worn, and that rail is in its turn used twice in the same manner. Each wing rail can thus be used four times, and when it is unfit for use as a wing rail, it can be put in the place of the check rail, and the check rails can then be used four times each, in the same manner as the wing rails previously. By this plan, the crossing may be renewed eight times with the same set of rails, before it is entirely worn out. In the ordinary crossing, the wing rails cannot be interchanged with the check rails, and also, as the two ends of the wing rails are not similar, they cannot be turned end for end, and can be worn only in two places each. An ordinary crossing can consequently be renewed only twice with the same set of rails before it is entirely worn out. The new crossing will accordingly last four times as long as an ordinary crossing. There are now 850 sets of the improved crossing in use on the London and North-Western and other railways.

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[*] From Newton's Lond. Journal, September, 1856.

The advantages to be derived from the use of the improved crossing are, simplicity of construction, and great saving in maintenance, both as regards labor and materials; the new plan is more particularly beneficial when the double-headed rail is used, but it may be adopted with advantage for any other description of rail.

The Chairman thought that the new crossing was a useful improvement on the ordinary construction, as it reduced the expense and frequency of repairs. In answer to an inquiry as to the actual saving effected in the expense of the crossing, Mr. Woodhouse stated that the new crossing would last four times as long as those on the ordinary construction, and therefore, taking the cost of a crossing at £8, the saving by the new plan was £24 per crossing, amounting to 75 per cent. saving on the total expense. This plan was applicable to all angles of crossing from 1 in 4 to 1 in 12 (the usual limits); the only difference that was made in the rails was in the angle to which they were bent, which varied according to the angle of the crossing.

AMERICAN PATENTS.

List of American Patents which issued from September 2d, to September 30th, 1856, (inclusive,) with Exemplifications.

SEPTEMBER 2.

1. For an *Improvement in Calendar Clocks;* Edwin Allen, Glastenbury, Conn.

Claim.—"1st, The change wheel and gear wheel, or its equivalent, fitted to rotate with the month wheel, and carrying the leap year wheel, occupying such a position on the change wheel, as to represent the month, February, said change wheel receiving every month one-twelfth part of a complete rotation on its axis, independently of the month wheel, and the leap year wheel receiving every year, in addition to its revolution around the axis of the change wheel, one-fourth of a complete rotation on its own axis, the movement of the change wheel and leap year wheel being produced by any means equivalent to those described, and the said wheels combined and operating upon the lever. 2d, The internally notched ring on the driving wheel, or its equivalent, that transmits motion from the month wheel to the yearly rotating month card, combined with the lever and its locking pin, and the pin on the month wheel, the whole operating to lock the wheel, or its equivalent, and through it the month card till the time for moving the same, and then unlocking it as long as is required to effect the movement."

2. For an *Improvement in Harvesters;* Homer Adkins, Plymouth, Illinois.

Claim.—"The rake, operated by means of the crank and guide blocks."

3. For an *Improved Machine for Feeding Sheets of Paper to Printing Presses;* David Babson, Groton, Connecticut.

Claim.—"The stocks with points attached, said stocks being placed in a reciprocating rame."

4. For an *Improvement in Cotton Seed Planters;* D. J. Beecher, Greenville, Miss.

Claim.—"The combination of the endless series of armed plates, with the slotted discharge tube."

5. For an *Improvement in Rotary Steam Engines;* P. D. M. Carmichael, Leroy, New York.

Claim.—"The rotary engine, composed of a piston with an eccentric rim, whose exterior fits at one point to the outer of the cylinder, and its interior, at a diametrically opposite point, to a central circular block, said rim working within a slotted rocker in an oscillating abutment."

6. For an *Improvement in Apparatus for Purifying Oil obtained from Mineral Coal;* Cummings Cherry, Pittsburgh, Penna.

Claim.—"The arrangement of the horizontal retorts, as combined with the copper heads of the rectifying chamber of the steam conduits to the oil boiler, and of the agitating apparatus."

7. For an *Improvement in Apparatus for Distilling Crude Oil from Mineral Coal;* Cummings Cherry, Pittsburgh, Penna.

Claim.—"Providing upright retorts, for the manufacture of oil from bituminous coal, with a closed top, and an opening at their bottom to be immersed in water."

8. For an *Improvement in the Preparation of Drying Oil from Oils Extracted from Bituminous Minerals;* Cummings Cherry, Pittsburgh, Penna.

Claim.—"Preparing the oil extracted from bituminous coal with litharge and rosin."

9. For an *Improved Apparatus for Arresting Carbon in Chimneys;* Hezekiah Chase, Lynn, Massachusetts.

Claim.—"The jet pipes, the deflector, and discharge flue, so that the water may first fall on the top of the deflector, and be discharged in a thin sheet over its edge, and around the mouth of the discharge flue, and this, whether the streams fall directly downward from the jet pipes and upon the deflector, or whether they may be first discharged upward, and next be caused to fall back and upon the top of the deflector, and so that such streams may serve not only to arrest carbonaceous matters which may escape or pass by and rise above the deflector, but to return them and cause them to be thrown into the receiver, after they have fallen with the streams upon the said deflector."

10. For an *Improved Filter;* David N. B. Coffin, Jr , Newton, Mass.

Claim.—"The method of applying the filtering diaphragm, and also, combining therewith the additional layers."

11. For an *Improved Street Sprinkler;* John F. Driggs, City of New York.

Claim.—"The peculiar arrangement of the perforated and slightly inclined pipe, in connexion with the uprights, or with equivalent brackets from the neighboring building and with the valve, the waste passage, and the water main, when arranged in such manner, that it may serve the double purpose of supporting awnings, signs, lamps, &c., and of rapidly and efficiently sprinkling the streets."

12. For an *Improved Bedstead;* Charles H. Gould, Concord, N. H.

Claim.—"The spring bed bottom, constructed essentially of the slats, pivoted at the lower ends, the bar, springs and band."

13. For an *Improvement in Ploughs;* Joseph P. Harris, Byhalia, Miss.

Claim.—"Combining with a sub-soil plough, a mould board, movable to different heights."

14. For an *Improvement in Adjustable Cut-Offs for Steam Engines;* Andrew Hartupee and J. Morrow, Assignors to themselves and J. P. Haigh, Pittsburgh, Penn.

Claim.—"The combination of the shaped lifter, slide, screw and stops, or their equivalents, constructed, arranged, and operating as an adjustable cut-off for steam engines."

15. For an *Improvement in Chargers for Shot Pouches;* John M. Hathaway, City of New York.

Claim.—"In combination with the slide of a shot charger, a locking apparatus, to prevent the accidental opening of the charger, but readily unlocked by the user. Also, the slots on the tube and the tongue button and spring on the tube, in combination, as a device for adjusting and holding said tubes."

16. For an *Improved Method of Boring and Mortising Hubs;* Henry Hayes, Quincy, Illinois.

Claim.—"1st, The adjustable frame with its attachments. 2d, The application of the rider to the carriage. 3d, The combination of the index, the lever, and the roller."

17. For an *Improvement in Ploughs;* Benaih C. Hoyt, Port Washington, Wis.

Claim.—"The adjustable rotary mould board combined with the beam and frame."

18. For an *Improved Raking Attachment for Reapers;* M. G. Hubbard, Penn Yan, New York.

Claim.—"The jointed rake bar, attached to the upright and connected with the pulley."

19. For an *Improved Machine for Testing Axes;* Warren Hunt, East Douglass, Mass.

Claim.—"The tool for testing the trueness of axes, consisting essentially of the bar and slotted gauge plate."

20. For an *Improved Fountain Ruling Pen;* Charles Ketchum, Penn Yan, New York.

Claim.—"A fountain ruling pen."

21. For an *Improvement in Spring Bedsteads;* Wm. H. Kimball and Andrew J. French, Assignors to themselves and Amos K. Noyes, Lynn, Mass.

Claim.—"Arranging and combining together and with the frame or bedstead, the springs and their connecting rods—the rocker bars, the levers, bars, straining screw rod, and crank nut."

22. For an *Improvement in Harvesting Machines;* Wm. A. Kirby, Buffalo, N. Y.

Claim.—"The combination of the main wheel, single plate, and rim. Also, hanging the seat to the plate and to the standard."

23. For an *Improved Pen and Pencil Case;* John H. Knapp, City of New York.

Claim.—"Placing the pen slide over or upon the tube which encloses the slotted tubes, the above parts being arranged, so that the pencil slide is shoved out at one end of the case, and the pen slide at the opposite end, and the working parts rendered so compact, that an extremely portable and extensive case is obtained."

24. For an *Improvement in Churns;* Loomis Lamb, Berlin, Conn.

Claim.—"Applying the auxiliary dasher to the shaft of the rotary dasher without any other shaft, so that the shaft of the rotary dasher may revolve in the hub of the auxiliary dasher—in combination with applying to the inside surface of the tub, a stop or projection, or equivalent means, and by which the auxiliary dasher may be stopped from revolving with the other dasher, when both are placed in the cistern, and the churn is in operation."

25. For an *Improvement in Ale and Beer Coolers;* James Mackintire, Somerville, Massachusetts.

Claim.—"The combination of the passages and gate, with the ale and water chambers, pipes, and zig-zag passages."

26. For an *Improvement in Condensers for Steam Engines;* David Mathew, Philadelphia, Pennsylvania.

Claim.—"The combination of the flat vertical tubes, connected by horizontal tubes, with rose pipes inside, and surrounded by the outer case, to condense by the combined action of air and water."

27. For an *Improved Process for Stiffening Hat Bodies;* James McCracken, Brooklyn, New York.

Claim.—"The process of stiffening wool hat bodies, by acidulating the hat bodies before applying the stiffening as a means of graduating and controlling the quantity and depth, to which the stiffener can penetrate the body of the felt, in combination with a pearl-ash solution of shellac, for stiffening the 'tip' or 'crown,' and a pearl-ash and sal-soda, combined solution of shellac for stiffening the 'brim.'"

28. For an *Improvement in the Manufacture of Black Bottle Glass;* John F. McCully, Gonzales, Texas.

Claim.—"The introduction of the clay slate as one of the ingredients in compounding the usual batch for the manufacture of black glass."

29. For an *Improved Buckle for Wearing Apparel;* Edward Parker, Plymouth, Conn.

Claim.—"Swaging or cutting the blank, or the bow and loop, entire or in one piece from a metal plate, and securing the tongue in the buckle by bending or closing the cross piece around the shank."

30. For an *Improvement in Rotary Steam Engines;* John Robingson, New Brighton, Pennsylvania.

Claim.—"The arrangement of the piston, projecting radially into, within, or through the hollow head, and forming inlet and outlet cavities or passages, on either side of it, across its whole breadth or face."

31. For an *Improved Candle Moulding Machine;* John Robingson, New Brighton, Pennsylvania.

Claim.—"Attaching a series of moulds to endless chains which have an intermittent movement, the moulds being formed of two parts, and opened and closed at the proper time by the jaws. Also, drawing the candles from the moulds by means of the jaws attached to the rod. Also, in connexion with the jaws, the plate, operating as shown, for the purpose of turning or conveying the candles in the receptacle."

32. For an *Improvement in Hay Rakes;* Hankles Heaberlin, Scipio, Indiana.

Claim.—"The combination of the revolving rake with the adjustable spring bow, so that said rake may be set to trip, and be tripped with such variable motion of the foot as may be desired."

33. For an *Improvement in Harvesting Machines;* Joel Y. Schelly, Hareford, and James Stauffer, Hosensack, Pennsylvania, Assignors to William Watson, St. Pauls, Minesota.

Claim.—"The combination of the driving wheel, supporting wheel, caster wheel, hinged tongue, and the main frame, when the said parts are arranged and operate in relation to each other."

34. For an *Improved Whiffle-tree for Detaching Horses from Carriages;* N. N. Selby, Fairview, Pennsylvania.

Claim.—"The application of the spring the whole length of the whiffle-tree, and turned over at each end, forming loops for the harness tugs, in combination with the bolt pins and fulcrum, operated by the lever."

35. For an *Improved Buckle for Wearing Apparel;* William Slade, Gum Creek, Ga.

Claim.—"The double jointed buckle."

36. For an *Improvement in Grain and Grass Harvesters;* Oren Stoddard, Busti, New York.

Claim.—"The cutters, pivoted to the finger bar, and operated by the cams on the shaft, when said cams are placed in varying positions."

37. For *Improved Invalid Chairs;* C. L. Taillant, City of New York.

Claim.—"The combination of the chair and adjustable drop or extension back, with the rack and adjusting or supporting rod."

38. For an *Improvement in Straw Cutters;* Shelton M. Thompson, Barren County, Kentucky.

Claim.—"The arrangement of the fixed knives, the revolving knives, the shaft, and spring, whereby the revolving cutters are held as rigidly parallel to the fixed cutter as if they were unyielding, and are as free to yield for the passage of obstacles, as those cutters which yield independently of the arms and shaft by which they are carried."

39. For an *Improved Self-Waiting Table;* Abdelah Watson, Falmouth, Kentucky.

Claim.—"The waiters, wire tracks, and driving cord."

40. For an *Improvement in Curtain Fixtures;* Ferdinand Wieterich and Conrad Hagan, City of New York.

Claim.—"Supporting one end of the shaft in a movable slide connected with the lever, which latter is made to act upon the cam."

41. For an *Improved Cutting Device for Harvesters;* C. Wheeler, Jr., Poplar Ridge, New York.

Claim.—"Attaching the fingers to the finger bar, and the caps to the fingers, and having a plate placed on each finger, on which plates the teeth of the sickle rest and work."

42. For an *Improved Method for Boring Hubs for Boxes;* Samuel H. Yocum, Shelbyville, Indiana.

Claim.—"Operating the bitts by the adjustable feed rods and lever with the mechanism, or its equivalent, in combination with the eight anti-friction wheels, temper screws, that confine the hub and expose a true circle to the bitts at any desired distance from the centre of the hub."

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43. For an *Improved Saw Set;* Wyllys Avery, Salisbury Centre, New York.

Claim.—"A traversing punch, arranged so that it can be vibrated or turned to suit the form or position of the saw teeth. Also, the adjustable stationary pin, so arranged as to bring the teeth of the saw into a proper position under the setting punch, when the scores between the teeth of the saw are faced on to said pin. Also, two separate frames, one hung each side of the anvil and setting punch, so arranged that when one is turned back out of the way of the handle, the other will support and sustain the saw. Also, the revolving blocks for adjusting the above mentioned frames, which support the saw during the process of setting."

44. For an *Improvement in Dress of Metallic Hemispherical Grinding Mill;* Anson Atwood, Troy, New York.

Claim.—"The series of radial ogee ribs and furrows, in combination with the intermediate or interposing ribs and furrows, cracking teeth, and hemispherical formed grinding surface."

45. For an *Improvement in Ladies' Riding Saddles;* Henry Adams, City of New York.

Claim.—"1st, The arranging of the near side horn, with the leaping horn attached directly to it, on the side of the tree or saddle, near the front and a short distance below the head of the same. 2d, Having the leaping horn attached loosely to the near side horn, so as to be capable of being reversed, and thus made to serve as a support or rest for the left leg while riding at a slow gait."

46. For an *Improvement in Breech Loading Ordnance;* G. W. Bishop, Brooklyn, New York.

Claim.—"The combination of the groove made around the seat of the breech pin, and the segments attached to the breech pin, the said segments being operated by a screw and toggle movement, or other equivalent means of spreading or expanding them into the said groove, or withdrawing them therefrom."

47. For an *Improved Machine for Manufacturing the Wooden Part of Brushes;* Thomas Mitchell, Lansingburgh, New York.

Claim.—"The combination of a circular saw with a cutting apparatus, for the purpose of applying circular saws to the cutting of the curved figures. Also, the combination of the apparatus, with a crown saw attached to an arbor, common to both, forming a tool for the advantageous manufacture of brush handles or other analogous work."

48. For an *Improved Process of Manufacturing Delaines;* John Marland, West Bridgewater, Massachusetts.

Claim.—"The method of operating upon wool by combing and subsequently carding."

49. For an *Improvement in Hanging Ships' Rudders;* Christopher N. Nixon, Ramsgate, England; patented in England May 12, 1854.

Claim.—"The use or construction as applied to sailing vessels for steering purposes of the groove or socket, whether the same be formed to extend from the top or near the top, to or near to the bottom of the stern post, whether the same be continuous or divided into sections or parts. Also, the rod, continuous or in sections, attached to the rudder, and combined with the groove, or other equivalent, attached to the stern post."

50. For an *Improvement in Cutting and Drawing Wires;* F. Noette, Brooklyn, New York.

Claim.—"1st, Feeding the circular plate to the circular cutters, and gauging the same by means of the rack shaft, with pinions attached, the pawl and ratchet, weighted lever, or equivalent, and gauge roller, arranged. 2d, Operating the reel or drum, or giving it a vertical vibratory movement by means of the right and left screw rods, with pinions attached, and made to gear alternately into the pinion on the shaft by means of the block, lever, bar and weighted lever. 3d, The reel or drum, when constructed as shown, so that it may be compressed or contracted to allow of the ready removal of the wire from its periphery."

51. For an *Improvement in Casting Artificial Tooth Plates by the Electrotype Process;* John L. Newell, Binghampton.

Claim.—"Constructing the linings in one piece, and simultaneously with the plate, by the electrotype process. Also, filling the interstices of artificial teeth, when attached to a metallic plate, with a metallic precipitate solidified."

52. For an *Improvement in Cartridges;* Julius Riedel, Pleasant Hill, Kentucky.

Claim.—"Making the pointed ball cartridge. 1st, The shape of the cartridge is such that one end is naturally loaded heavier than the other, as represented in the section, thereby causing that end to go forward, thus guarding against all revolving motion except a simple winding or peristaltic one. 2d, The constructing the hemispherical end of the cartridge stronger and heavier than the conical end, having several objects in view, viz: that the loading of shot or balls on the inside may be kept together a considerable distance after leaving the gun, that the lighter conical end may serve to keep the whole in the given direction till the cartridge is burst, and when burst on or near its base, give free egress to its contents."

53. For an *Improved Lock;* Henry D. Russell, Naugatuck, Connecticut.

Claim.—"Liberating the knob and its stem from all connexion with the main bolt in freeing the crescent plate, by the movement of the smaller bolt, produced by the cross bar, or its equivalent, operated by the key of the door."

54. For an *Improved Wind-Mill;* John R. St. John, Lockport, New York.

Claim.—"1st, The traverse table and tail-piece for carrying the reduced part of the main shaft, and for sustaining the main shaft horizontally on the screw pivot, with the arrangement thereon of the rudder vane for its perpendicular movement. 2d, The main shaft with its hinder portion reduced, with the circular cogged rack, the collar, and the spiral spring, working therewith. 3d, The rudder vane, as performing the two offices of keeping the sails to the wind, by moving the traverse table horizontally, also as carrying the rod, and the governor vane or globe for giving a vertical movement."

55. For an *Improved Machine for Sweeping Streets;* Robert A. Smith, Brooklyn, New York.

Claim.—"1st, Placing the main broom cylinder under the axle of the traveling wheels. 2d, The curved guides of broom cylinder axle, concentric with the driving pulley, for keeping the driving band tight in all positions of the said cylinder. 3d, Hanging the conveyor on its driving shaft, with its lower extremity resting on wheels running on the surface of the ground. 4th, The arrangement of screw, box, and guides with the shaft of the gutter brush, for regulating the inclination, and preventing the oscillation of the said brush. 5th, The combination of the cylinder brush and gutter brush with the elevators."

56. For an *Improvement in Washing Machines;* Riley Smith, Towanda, Penna.

Claim.—"Connecting the hand and lever rubbers by a pivoted brace, which serves the double purpose of a guide in operating the lever rubber, and a brace for raising up and holding in a convenient position the hand rubber."

57. For an *Improvement in Apple Parers;* John D. Brown, Cincinnati, Ohio.

Claim.—"The returning or reversing action."

58. For an *Improvement in Washing Machines;* Israel F. Brown, Columbus, Ga.

Claim.—"The slatted cylinder, having a diagonal or oblique corrugated board at each end, the cylinder being partially immersed within the box."

59. For an *Improvement in Steam Engines;* William A. Clark, St. Louis, Missouri.

Claim.—"The arrangement of two or more pistons on the one piston rod, within the one cylinder, divided into compartments, the movement of each piston being limited to its respective compartment, and all the pistons traveling in the same direction."

60. For an *Improved Extinguisher for Fluid Lamps;* Wm. B. Carpenter, Brooklyn, New York.

Claim.—"The divided cap or extinguisher, in combination with the springs, and the ring."

61. For an *Improvement in Repairing Railway Bars;* Joseph D. Cawood, Marshall, Michigan.

Claim.—"The movable press block, having its edge formed to the side of the rail, in combination with another block, with its edge of a similar but reversed form (the movable block to be operated by two cams, or in any other convenient manner), for the purpose of pressing between them a T, or otherwise shaped rail, thereby facilitating the difficult operation of welding or renewing the ends of such rails, after they have been damaged."

62. For an *Improvement in Artificial Fuel;* Robert Courtney, Albany, New York.

Claim.—"The rendering coal dust or screenings into a merchantable article of artificial fuel, by combining coal dust with clay, lime, and coal tar, or other bituminous or resinous material, and subjecting them to all the parts of the process."

63. For an *Improved Method of Feeding Sawing Mills;* Calvin and George S. Dilkes, Allowaystown, New Jersey.

Claim.—"Giving motion to the pawls which actuate the feed wheel, by means of the cord and pulley or short cylinder and its stud, in combination with the slotted lever, arm, and its plate."

64. For an *Improvement in Lubricating Throstle Spindles;* George H. Daugherty, Crozerville, and Thomas G. McLaughlin, Philadelphia, Pennsylvania.

Claim.—"The lubricator of throstle spindles."

65. For an *Improvement in Seed Planters;* John Fordyce, Morgantown, Virginia.

Claim.—"In combination with the hopper and its adjustable openings, the hinge board and its blocks and figures, for regulating the discharge of the grain from said hopper, and ensuring regular feeding."

66. For an *Improved Mode of Attaching Horses to Vehicles;* George H. Gray, Clinton Mississippi.

Claim.—"The plates attached to the harness, and the plates on the shafts with loops or clasps attached to the levers, with the pins on them and the dogs, levers, and rods."

67. For an *Improvement in Links of Horse Powers;* Albert W. Gray, Middletown, Vermont.

Claim.—"Constructing the links composing the endless chain of corrugated sheet metal, so that the corrugations shall serve both as hinges for connecting the links, and as cogs for gearing with the cog-wheel on the driving shaft."

68. For an *Improvement in Pans for Evaporating Sugar;* Samuel H. Gilman, New Orleans, Louisiana.

Claim.—"An evaporator formed by the combination of a train of open boilers, the boiler X to receive the first, and the boiler Q to receive the last fire; and each of the boilers in succession presenting an extent to the fire in the inverse ratio of the intensity of the fire, as well as of its (the boiler's) cubic capacity. Also, the construction and use of a flue, formed by a series of open boilers, and being in a series of sections of its length, divided longitudinally and vertically by water legs or strata of juice into two or more flues or spaces, the number of flues increasing from one section to the next, as the distance from the furnace increases, and the number of sections into which it is so divided corresponding to the number of holes in the series, and each section being shorter than the boiler in which it is placed, so as to leave a space between each section, where the flue is undivided in its transverse section."

69. For an *Improvement in Hand Corn Planters;* Heman B. Hammon, Bristolville, Ohio.

Claim.—"The employment of hexagonal or many sided revolving wheel, having offsets applied in connexion with the plunger and seed tube."

70. For an *Improvement in Reversing Gears;* George Juengst, City of New York.

Claim.—"The arrangement of the disks, the screw pivots, and the springs, or their reversal equivalents, whereby the action of the nipping pawl is reversed, and the motion communicated by it, changed in direction, without any change of direction or cessation of motion in the moving power."

71. For an *Improvement in Metallic Car Springs;* Danforth Johnson, Chicago, Ill.

Claim.—"The combination and arrangement of a number of springs radiating from a central stud, and secured at the circumference or rim to a box or bed plate. Also, the arrangement of the convex bed plate, over which the springs bend, in combination with the stud or pillar to resist the lateral motion of the car or carriage."

72. For an *Improvement in Collision Apparatus for Railroad Cars;* John Kulinski, Charleston, South Carolina.

Claim.—"Protecting rail road trains againts the injurious effects of collision, by the attachment to their front and rear, of a series, kept at a distance from each other by elastic and rigid resistances, in such a way that a collision taking place, said shields are to fall back successively upon each other from the fore to rearmost, the resistances to yield to the shock, alternately, and in succession, by the operation of tubes and snap locks, or their equivalents.

73. For an *Improved Screw Cutter;* James W. Lyon, Brooklyn, New York.

Claim.—"The use of the slide rest, slide cutter tool, wire holder box, and spring clamp dies, or their equivalents."

74. For an *Improved Grain and Grass Harvester;* William P. Maxsom, Albion, Wis.

Claim.—"The wheel attached to the driving wheel, in combination with the curved sliding lever (on which the driving wheel is hung), and straight lever."

75. For an *Improved Mode of Suspending by Hydraulic Puppet Valves;* George Trott, R. H, Cole, and Wm. A. Clark, St. Louis, Missouri.

Claim.—"The combination of the ball, loose socket, and anti-friction washer, when employed to connect an elastic or yielding valve with its stem."

76. For an *Improvement in Marble Sawing Machines;* Jose Toll, Locust Grove, Ohio.

Claim.—"The particular combination and arrangement of the fender bars, with the adjustable guide pieces, when the same are constructed and arranged to operate in relation to each other."

77. For an *Improved Wind-Mill;* Ephraim Whitman, Abington, Massachusetts.

Claim.—"The combination and arrangement of the rotary wind flume, the series of turning blinds or gates, and the wind wheel. Also, in combination with the wind flume and its wheel, the series of guide plates, and the concentric tubular tapering case. Also, arranging the transferring shaft in the turning axis of the wind flume, and so as to pass through the lower journal thereof, and thereby enable the wind flume and driving shaft, and its beveled gear, to revolve around such transferring shaft and the beveled gear thereof, and transmit power through the shaft, under any position of the rotary flume."

78. For an *Improvement in Machinery for Forming Hat Bodies;* D. G. Wells, City of New York.

Claim.—"1st, The mode of guiding the current of air from the picking cylinder in their passage to the cone. 2d, The mode of regulating the secondary currents of air by means of the wedge-shaped apertures, formed by the valves."

79. For an *Improved Method of Drawing from Manufacturing Enclosures, Waste Gases, Steam, &c.;* Robert F. Brower, Assignor to Samuel A. and J. L. Brower, Bloomfield, New Jersey.

Claim.—"The operation of drawing off waste steam or gases by mechanism or heated currents, from buildings or apartments, where drying, steaming, or chemical operations are conducted."

80. For an *Improvement in Jacquard Looms;* James C. Cooke, Assignor to Hotchkiss & Merriman, Manufacturing Co., Waterbury, Connecticut.

Claim.—"1st, The combination of the lifting bar, with the sliding hook and rocking piece, for operating the needle. 2d, The use of a pattern cylinder, having a reciprocating, horizontal, and vertical movement combined with the movement of rotation on its axis."

81. For an *Improved Saw Gummer;* L. A. Dole, Assignor to Dole, Silver & Felsh, Salem, Ohio.

Claim.—"Arranging the cam or moving crank below the die, either in or below the die block, so as to draw down the punch or male die block. Also, the cam lever, with a movable fulcrum, in combination with the opening, so constructed and arranged as to traverse the bar with a positive motion in each direction, as the lever is vibrated."

82. For an *Improved Shingling Bracket;* Lewis A. Goodsell, Assignor to self and Daniel H. Hott. Southington, Connecticut.

Claim.—"A combination of the foot or feet, the claw or pin pointed base, and the hinged braces made fast and adjustable to each other by the catches, and dove-tail tongue receiving wedge."

83. For an *Improvement in Harvesters;* Wm. H. Seymour and Henry Pease, Assignors to Wm. H. Seymour and Dayton L. Morgan, Brockport, New York.

Claim.—"In combination with the main wheel and removable wheel, a frame capable of allowing the shifting of the former, and the removing or replacing of the latter, when the machine of the latter is to be converted from a reaper to a mower, or vice versa."

84 For an *Improvement in Harvesters;* Wm. H. Seymour and Henry Pease, Assignors to Wm. H. Seymour and Dayton S. Morgan, Brockport, New York.

Claim.—"The particular arrangement of the clotch and clutch lever, with regard to the conductor's seat and platform, and the shaft, from which motion is communicated to both the rake and sickle, as that the operator from his seat, having a distinct view of the platform, can engage or disengage said rake with his foot, whilst the sickel continues to run. Also, the combination of the universal joint for connecting the shafts, the sleeve and plate, with its guide and gimbal joint for giving the rake its traverse movement. Also, the bow and rake-head, so formed as to incline towards their outer ends, and so acting as to cause the bent or entangled straws to slide off into the platform."

85. For an *Improved Faucet;* Joseph Goodridge, Assignor to the Boston Faucet Company, Boston, Massachusetts.

Claim.—"Arranging between the caoutchouc spring, and the screw cap of the neck of the back faucet, a metallic annulus or guard ring, in order to prevent the adhesion of the cap to the india rubber spring, not meaning to claim a metallic washer as ordinarily used, but the specific application of a metallic ring to prevent a difficulty incident to the peculiar relations of parts. Also, the arrangement of the annular groove in the stem of the valve, and with reference to the sides of the spring or valve chamber, in manner and for the purpose, or so as to produce the new and useful result as specified, the said groove being intended to receive the foot of the spring made tapering, or frusto conical, in manner and for the purpose of preventing it from being caused to adhere to the sides of the said chamber by oxidation of the metal."

86. For an *Improvement in Furnace Smoothing Irons;* John Taggart, Roxbury, Assignor to self and Vernon Brown, Boston, Massachusetts.

Claim.—"Arranging the bellows between the handle and furnace or body of the flat-iron, and connecting said bellows to both, so that the said handle may be used to operate either the bellows or the flat-iron, as circumstances may require. Also, making the bellows tube or conductor in two separate pieces, and attaching them respectively to the cover and body of the furnace, so as to operate together when the cover is down, and to be separated when the cover is raised."

87. For an *Improved Mode of Adjusting Carriage Tops;* Cyrus W. Saladee, Columbus, Ohio.

Claim.—"The lateral rod, in combination with the 'top-props.' Also, the perpendicular rods, in combination with the lateral rod, and the back of the seat, for the purpose of throwing back or raising up the top while seated in the carriage."

88. For an *Improvement in Sewing Machines;* Charles R. Gardiner, Detroit, Mich.

Claim.—"1st, The sharp pointed needle, having a flexible beard for sewing in woven, felted, or other close fabrics. 2d, The adjustable slide, so arranged as to close the beard of any sized needle that may be used in the machine. 3d, The guide, consisting of the 'thread channel' and the needle passage, with the side thereof either slightly inclined or provided at the top with the inclined groove, and so operating the feed-motion given to the cloth, that it shall carry the thread in proper position that it shall be caught by the hook or beard of the needle. 4th, The folding plate, or its mechanical equivalent. 5th, Sewing with a machine through one fold or corrugation of the material at a time; the cloth being fed along at right angles, or nearly so, to the line of the fold."

89. For an *Improvement in Lamps for Burning Fluids;* Salmon Bidewell, Rochester, New York.

Claim.—"The mode of compressing the wick, so as to prevent any change in the light caused by the jar of the lamp, and to prevent the escape of the burning fluid faster than is designed to secure the gas generated from the same, and to enable the use of any desirable fluid for lamp purposes."

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90. For an *Improved Chimney Cap;* William Brownell, Newport, Rhode Island.

Claim.—"The construction and arrangement of the ventilator."

91. For an *Improved Machine for Dressing Felloes;* William M. Bullock, Marcy, Indiana.

Claim.—"The rotating ring or band placed within the stationary ring or band, the ring or band having the cutter head shaft fitted to it, the shaft being rotated by the gearing."

92 For an *Improved Feed Motion for Shingle Machines;* John Broughton, Chicago, Illinois.

Claim.—"The disk wheel, with knives, face guide, and face cam, attached and used in connexion with the vibrating bed."

93. For an *Improvement in Heading Bolts;* Ebenezer and Philemon Coleman, Philadelphia, Pennsylvania.

Claim.—"The levers with rollers attached to them, and the ratchet roller attached to the pendant plate. Also, the heading and jaws provided with dies, so as to operate conjointly with the rollers."

94. For an *Improvement in Dentists' Forceps;* John G. Coates, Big Lick, Virginia.

Claim—"Constructing forceps with rotating beaks to adapt themselves to the exterior formation of the tooth."

95. For an *Improved Saw-set;* Abraham Casey, City of New York.

Claim.—"The combination and arrangement of the stock having a transverse kerf, level bolster, and punch. 2d, Arranging the bolster on a turning screw pin, which moves in a slot and has a clamping nut."

96. For an *Improvement in Reefing Ships' Sails upon Extra Yards;* Joseph S. Foster, Buffalo, New York.

Claim.—"The double yard or extra yard of two pieces, placed about midway between the upper and lower yards, the sail passing between the two pieces."

97. For an *Improvement in Fire Arms;* Edmund H. Graham, Manchester, N. H.

Claim.—"1st, Arranging the chambers in which the powder is placed, and the chambers in which the balls are placed, at right angles to each other, or nearly so, and so as to communicate with each other. 2d, Covering each powder chamber at the time of the discharge, with a protecting cap or plate."

98. For an *Improvement in Harvesters;* William Gage, Buffalo, New York.

Claim.—"Raising and lowering the finger bar and cutters, by means of swinging the outside frame, to which the finger bar is attached, upon two pivots upon the inside frame, and holding the same where placed, by means of serrated plates and tightening rod, when said frames are constructed and arranged to operate in relation to each other, and the driving wheel, finger bars, and cutters. Also, the peculiarly adjustable mould board, in combination with the wheel and its supporting arm when used in mowing, for the purpose of protecting the wheel and arm from loose grass, and prevent its lodgement thereon."

99. For an *Improvement in the Preparation of Hides for Tanning;* George W. Hatch, Princeton, Illinois.

Claim.—"The use of smoke from wood or other equivalent combustibles, in the preparation of hides for rapid tanning."

100. For an *Improved Mode of Attaching Shafts to Sleighs;* George Kenney, Milford, New Hampshire.

Claim.—"Attaching the shafts to the runners of the sleigh by means of the eyes and rods, said eyes and rods being attached to the cross pieces provided with springs."

101. For an *Improvement in Granulating Metals;* John Feix, San Francisco, Cal.

Claim.—"The use of the outer and inner vessels, in connexion with the pipe and its elbows, for keeping the water in circulation, and for granulating the metals."

102. For an *Improved Machine for Cutting Paper;* Hervey Law, City of New York.

Claim.—"The combination of the rising and falling platform, and clamping frame, by means of toggles, said toggles having cranks connected with them, the pintles of which work in curved grooves, or otherwise actuated."

103. For an *Improved Carpenter's Bench;* J. W. Mahan, Lexington, Illinois.

Claim.—"The carpenter's and cabinet-maker's assistant bench."

104. For an *Improved Printing Press;* A. B. Newbury, Windham Centre, N. York.

Claim.—"1st, The rotating and reciprocating printing cylinder, operated by means of the endless racks, pitman, and bars. 2d, The revolving fly."

105. For an *Improvement in Churns;* Albert Pease, Weston, Vermont.

Claim.—"The combination of the two fixed boards on the dasher handle, and a sliding board or its equivalent moving between them."

106. For an *Improvement in Locomotive and Steam Boiler Furnace;* William P. Parrott, Boston, Massachusetts.

Claim.—"The hollow box or cone, having tubes for the passage of the smoke and gas, and apertures for the admission of heated air, so arranged as intimately to mix the two."

107. For an *Improved Clevis;* Edwin A. Palmer, Clayville, New York.

Claim.—"The pin provided with a spring and arms, in combination with the projection in the head and openings through which the arms may pass."

108. For an *Improvement in Variable Cut-offs for Steam Engines;* Charles H. Reynolds, Lewiston, Maine.

Claim.—"The arrangement of the suspended lifting rods with their studs secured to the rod or rods, and operated on by the arms of a rock-shaft, and the plate or plates with beveled edges, sliding on the said valve rod or rods, said plate or plates being operated on by the governor, and operating on the lifting rods."

109. For an *Improvement in Cotton Pickers;* B. G. Shields, Marlin, Texas.

Claim.—"The application of a fan or fans to the gathering chain, as a means of removing the gathered cotton from said chains."

110. For an *Improved Shingle Machine;* P. O. Sherwin, Jamestown, New York.

Claim.—"The stops, in combination with the notches or teeth on the set wheels."

111. For an *Improvement in Harvesting Machines;* George W. Tolhurst, Cleveland, Ohio.

Claim.—"The combined use of the single row of removable pins, with the adjustable angular slot, for the purpose of procuring a vibratory motion to be applied to the cutters."

112. For an *Improvement in Riding Saddles;* Pascal Plant, Chicago, Illinois.

Claim.—"The sockets and vertical shanks, provided with removable springs."

113. For an *Improved Shingle Machine;* David D. Tupper, Boston, Mass.

Claim.—"The method of arranging and operating the cutter head, whereby the pressure rolls are inclined to correspond to the inclination of the face of the bolt."

114. For an *Improved Construction of Iron Fence Posts and Ties;* John B. Wickersham, City of New York.

Claim.—"1st, The double lipped post or tie cornered or mortised upon opposite and corresponding sides, in combination with the inclined corner key, for holding and crimping the rail. 2d, Constructing the fence tie and key above named, that it may be attached to a wood post, in order to take up the lax tension of wire and flat hoop iron, and thus act as a compensator for the expansion of the metal."

115. For an *Improvement in Self-Acting Rakes for Harvesters;* Jesse Whitehead, Manchester, Virginia.

Claim.—"The combination of the swinging arm and traveling carriage, moving together and independent of each other. Also, the locking arm at each end of its traverse movement, so that the rake cannot swing around, whilst the carriage and raker reciprocate together and discharge the gravel."

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116. For an *Improved Fly-Trap;* Samuel Arnold, Green Hill, Tennessee.

Claim.—"1st, The employment of the revolving perforated grooved and hollow cylinder, applied in connexion with the reticulated piston and glass vessel. 2d, The arrangement for retaining the piston elevated while the flies are being entrapped, in connexion with the device for releasing it when necessary."

117. For an *Improvement in Ovens;* Hosea Ball, City of New York.

Claim.—"The perforated interior chamber, in combination with the rotary reel and the swinging platforms thereon self-discharging."

118. For an *Improvement in Reefing Top-sails;* Isaac Boss, Brooklyn, New York.

Claim.—"1st, The running of lines from the reef between the head of the top-sail and the fore part of the yard, thence direct to the topmast head. 2d, The arrangement of reef tackle beneath the yard, running from the end of the yard to the quarter on deck. 3d, The peculiar mode of strengthening the sail by bands and double ropes."

119. For an *Improvement in Corn Planters;* Malender Bates, Carlton, New York.

Claim.—"The rotating ratchet wheel, provided with feeding apertures, in combination with the wire screen, the spring pawl, the guard pin and wire button."

120. For an *Improved Method of Feeding and Sawing Shingles;* George Craine, Fairfield, Iowa.

Claim.—"So arranging the carriage with regard to the saw, as that the saw shall enter the bolt at or near the centre in length of the shingle, and cut towards both its ends at the same time. Also, as a device for feeding the bolt to the saw, so as to take the shingles therefrom 'but and point,' alternately, the worm wheel working into the double racks. Also, the combination of the hinged piece, with its pin and feeding tooth, and the ledge and trigger on the fixed piece, for the purpose of connecting and disconnecting at proper times, the carriage with the feeding shaft, so that it may traverse on its ways."

121. For an *Improved Stave Jointer;* A. H. Crozier, Oswego. New York.

Claim.—"The wheel with cutters attached, in combination with the adjustable gauges or plates."

122. For an *Improved Mode of Adjusting the Slats of Window Blinds;* Benajah C. English, Hartford, Connecticut.

Claim.—"1st, The manner of adjusting the slats of window blinds, by the use of the gear wheel and rack. 2d, The method of fastening the slats at any required angle by the use of the clutch. 3d, The whole in combination."

123. For an *Improved Machine for Painting Carriage Wheels;* S. B. Fuller, Worthington, Mass.

Claim.—"The vibratory and rotating shaft passing into the tub."

124. For an *Improved Explosive Shell;* A. M. George, Nashua, New Hampshire.

Claim.—"The arrangement and combination of the chambers, to constitute a new projectile for the scattering of melted metal or other incendiary substances."

125. For an *Improvement in Feed Rolls of Straw Cutters;* Alexander Gordon, Rochester, New York.

Claim.—"The construction and arrangement of the feed roller and shaft."

126. For an *Improvement in Metallic Braces for Heels of Boots and Shoes;* George W. Griswold, Carbondale, Pennsylvania.

Claim.—"The application to boots or shoes of a brace or support, for uniting the heel and counter, and to prevent one from twisting or running over on the other."

127. For an *Improved Device in Machines for Manufacturing Bed-Pins;* Henry Gross, Tiffin, Ohio.

Claim.—"Fixing the head forming V cutter, to a lever operated by a longitudinal movement of the pin, whereby but one hand of the operator is required for forming the entire pin."

128. For an *Improved Hand Stamp;* Charles W. Hackett, Elmira, New York.

Claim.—"The arrangement of a rotating printing press, with two sets of type alternating with each other, in such manner, that at the same time one set of type is leaving its impression, the opposite or corresponding set is being supplied with ink."

129. For an *Improvement in Corn Shellers;* James J. Johnston, Alleghany, Penna.

Claim.—"The drum, with the two sets of teeth, and its combination with the vertical guide boards and spring plates."

130. For an *Improvement in Brick Machines;* William A. Jordan, Thibodeaux, La.

Claim.—"The tables and shoving heads, in combination with the rotary scrapers, and curved guards."

131. For an *Improvement in Manufacturing Ingrain Carpeting;* David B. Kerr, City of New York.

Claim.—"A parti-colored ingrain carpet, in which the warp threads of one or more plies are parti-colored in whole or in part, and are combined with solid colored weft threads to form the design."

132. For an *Improved Machine for Notching Hoops;* Daniel Lamson, East Weymouth, Massachusetts.

Claim.—"The knife attached to the reciprocating frame, in combination with the inclined plate attached to the frame."

133. For an *Improved Omnibus;* D. O. Macomber, City of New York.

Claim.—"The arrangement of two series of independent seats on each side of the carriage body. Also, connecting the body with the frame of the running gear, so that it will rock thereon, in combination with the screw bolts and adjusting nuts at the ends, for the purpose of setting the body at any desired inclination with the frame of the running gear. Also, connecting the brake levers with the shaft of the stop and foot wheel, in combination with the strap which passes into the inside of the carriage body to be operated by the passengers if required."

134. For an *Improvement in Securing Spokes in the Hubs of Wheels;* Robert Moor, Westport, Indiana.

Claim.—"The oblique form of spoke mortise, enabling all the necessary beveling and taper of the spoke to be on that side which is in advance when the wheel is rotating forward, leaving the 'rear' side straight for its entire length, thus adding to the strength and reducing the labor of constructing the spoke."

135. For an *Improvement in the Air Engine;* Thomas McDonough, Middletown, Connecticut.

Claim.—"Combining the hot and cold cylinder (or cylinders,) by an interposed cylinder to prevent the one from being affected by the temperature of the other. Also, the working piston (or pistons) working in the cold cylinder, in combination with the dumby piston (or pistons) which extends from the cold to the hot cylinder. Also, the vertical position of the pairs of cylinders, that the heated part of the engine may be above the cold parts, in combination with the means for keeping the lower part of the engine cold. Also, the arrangement of the metallic surfaces through which the air or other gas passes, by making such metallic surface of sheets of wire gauze rolled up and placed in a surrounding vessel, so that the air or other gas shall pass in films between the several coils, in contradistinction to passing through the meshes of wire gauze."

136. For an *Improvement in Making Brass Kettles;* O. W. Minard, Waterbury, Connecticut.

Claim.—"The use of rotary shears or cutters, having a hinged or sliding piece constructed and operating to carry one of the shafts and one of the cutters from a cutting position, and to quickly and accurately replace it when desired."

137. For an *Improved Machine for Grinding Saws;* Albert S. Nippes, Lower Merion, Pennsylvania.

Claim.—"In combination with the face plate of a machine for grinding saws, a guide pattern or former, which can be used for giving shape to the saw plate, by causing the face plate or stone to approach or recede from each other, to vary the bevel or thickness of the saw plate, or to compensate for the wearing away of the stone whilst acting on said plate, or both."

138. For an *Improvement in Blow-pipes;* Steward B. Palmer, Tully, New York.

Claim.—"The two wind-chests connected by the pipe, provided with the faucet, when said chests thus connected are arranged and used in connexion with the pump, reservoir, wick tubes, and nozzle, connected with the pipe."

139. For an *Improved Lubricator;* Norman W. Pomeroy, Meriden, Conn.

Claim.—"So constructing and connecting the disk, which forms the bottom of the oil vessel, that by reason of its curved or waving shape, the central part may be readily pressed inward by the thumb or finger, while its shape will cause it to return to its orinal position, immediately on removing the pressure."

140. For an *Improvement in Cast Iron Pavements;* George M. Ramsay, City of N. Y.

Claim.—"The iron hexagonal paving blocks with legs or lugs below, when united and secured by the iron clips or bands, so as to form the flexible pavement."

141. For an *Improvement in Hay Rakes;* Isaac J. Robbins, Penn's Manor, Penna.

Claim.—"The hinged arms with their revolving teeth, in combination with the sliding blocks."

142. For an *Improved Hydraulic Brick Press;* Ethan Rogers, Cleveland, Ohio.

Claim.—"The employment or use of two pumps with the mechanism for working the same under different pressures, when arranged to operate in relation to each other and mould, for the purpose of pressing and removing the brick."

143. For a *Self-Regulating Draft for Chimney Tops;* Josiah A Boyce, Lee, Mass.

Claim.—"The application to the top of a chimney or a draft flue of a frame, having one or more turning slats or dampers hung in it, said frame being provided with a rudder, so as to be always turned to a proper position by the action of the wind, and the dampers being combined with a spring mast with sail on top, so as to be closed more or less by the action of the wind, and automatically opened during a calm."

144. For an *Improved Hoop Machine;* Joseph and Sylvester Sawyer, Fitchburgh, Mass.

Claim.—"The methods of hanging the knife and connecting it with the feeding rolls, for the purpose of retaining it midway between the rolls, and parallel with the direction of the hoop pole."

145. For an *Improvement in Carding Engines;* A. D. Shattuck, Grafton, Mass.

Claim.—"The application to the main cylinders of carding engines of two or more variable cylinders, in combination with a doffer."

146. For an *Improvement in Lanterns;* Sinclair Shannon, Buffalo, New York.

Claim.—"Connecting the lamp pot to the main body of the lantern by the bail."

147. For an *Improvement in Lock for Freight Cars;* Thomas Slaight, Newark, New Jersey.

Claim.—"The hasp, fitted over the socket of the lock, and secured thereon by the plug or bolt, which passes through the hasp and socket into the lock."

148. For an *Improvement in Carding Engines;* A. D. Shattuck, Grafton, Mass.

Claim.—"The stripper, in combination with the doffer, and with a main cylinder of a carding engine."

149. For an *Improvement in Grain Separators;* Hamilton E. Smith, Philadelphia, Pennsylvania.

Claim.—"The arrangement of the vertically vibrating shakers, and horizontally vibrating screens, for the purpose of separating grain and other material."

150. For an *Improved Grain Threshing Machine;* Isaac S. Spencer, Guilford, Connecticut.

Claim.—"The cylinders provided with ribs or flanches, placed obliquely or angularly with their axes."

151. For an *Improvement in Churns;* Franklin Thorpe, Shelbyville, Illinois.

Claim.—"The arrangement and combination of the fast and loose buckets, the latter being slackened from the former in the act of opening, and tightened to it in the act of closing, by the screw upon the spindle."

152. For an *Improved Tool for Forming Grooves around the Orifice of Bottles or other Vessels, made from Plastic Substances;* Amasa Stone, Philadelphia, Penna.

Claim.—"The revolving flanch, constructed and arranged to form a groove in the end of the bottle nose or other vessel."

153. For an *Improvement in Feather Edge Gauges;* G. G. Townsend, Rochester, New York.

Claim.—"The combination of the knife and feather guard."

154. For *Improved Devices in Sawing Machines;* William P. Wood and Samuel De Vaughan, Washington, D. C.

Claim.—"1st, The arrangement of the driving beam, in combination with the rocking beams. 2d, The arrangement of the fluted feed rolls, in combination with a reciprocating wedge-shaped saw blade. 3d, The wedge-shaped saw blade."

155. For an *Improvement in Warm Air Furnaces;* William M. Wright, Pittsburgh Pennsylvania.

Claim.—"1st, The manner of increasing the radiating surface by the use of the movable plates. 2d, The manner of constructing the ash-box with its rim to receive the fire pot, and projecting arms or supports."

156. For an *Improvement in Machines for Sawing Marble;* Alonzo Webster and D. K. Bennett, Montpelier, Vermont.

Claim.—"The combination and arrangement of the movable stirrups, cross bars, and the arbors, in the reciprocating frame."

157. For an *Improvement in Boat Oars;* Rufus Rode, Manchester Township, Assignor to John Denig, York, Penna.

Claim.—"The combination of the oscillating plate and double jointed arms, forming a double jointed boat oar, operating on an oar or rower box, for the purpose of enabling the oarsman to row forward with his face fronting the bow of the boat."

158. For an *Improved Belt Punch;* Augustus Simpson, Worcester, Assignor to Samuel H. F. Bingham, Weston, Mass.

Claim.—"The combination and arrangement of the tit and the cutter, whereby the conical form is given to the article punched, the cutting facilitated, and performed with the edge of the cutter free."

159. For an *Improvement in Reaping and Mowing Machines;* William P. Wood, Assignor to self and Samuel De Vaughan, Washington, D. C.

Claim.—"A balance frame, supported and turning upon an axis of motion back of the axis of the driving wheel, when used in connexion with the angular or oval-shaped gearing, or its equivalent, and the bifurcated stanchion brace, in combination with a main frame, rigidly supported at its forward end upon a truck carriage or wheels."

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160 For an *Improved Fire Arm;* Joseph Adams, Cleveland, Ohio.

Claim.—"The employment of a revolving barrel formed from a single piece of metal with three bores of equal diameters, or four bores in opposite pairs of unequal diameters, when so arranged that the bores are located as near together as practicable, to secure the proper strength of dividing metal, while the relative positions of said bores are such that their outermost tangents shall revolve in a common circle around the central point between them, and be equidistant apart, the outer periphery of the barrel, also, so conforming to the bores as to dispense with unnecessary metal, for the purpose of securing the utmost compactness, lightness, symmetry, and strength, with a given capacity, and at the same time of retaining perfect convenience in respect to revolving and discharging. Also, the employment (instead of separate breech pins,) of a single breech piece, provided with branches or pins fitting the several bores, and secured therein by a right and left nut. Also, the socket, in combination with the breech piece and collar. Also, the peculiar construction, arrangement, and combination of the hammer, main spring and trigger, as adapted to the rest of the gun, and operating both to hold the hammer cocked and down upon the nipple, till set free by moving the trigger."

161. For an *Improvement in Brick Machines;* Henry Brad, Greencastle, Indiana.

Claim.—"The self-adjusting frame, for the purpose of removing the brick from the moulds into the apron after they are pressed, operated by means of spring and projections on the revolving journal."

162. For an *Improvement in Grid-Irons;* William Bennett, City of New York.

Claim.—"The pins or elevators attached to the bars or seats of the grid-iron, used in connexion with the ventilating cover."

163. For an *Improvement in Locks;* George W. Coppernoll, Ohio, New York.

Claim.—"1st, The swinging guards in front of the bolt chamber, actuated by the fixed portion of the key, in combination with the sliding guards, actuated by the secondary key. 2d, The eccentrics, arranged relative to each other and the bolt, and actuated by the secondary key, after the removal of the guards. 3d, The combination of the swinging guards, tumblers, and spring catches."

164. For an *Improvement in Self-Heating Smoothing Irons;* William D. Cummings, Washington, Kentucky.

Claim.—"The trough extending rearward from the bottom of the fire space, in combination with the ash receiver, open at the side next the said space, and provided with a registered top, for the purposes of cleanly separation and removal of the ashes, &c."

165. For an *Improved Mode of Hermetically Sealing Bottles;* Mills B. Espy, Philadelphia, Pennsylvania.

Claim.—"The improvement of the two part screw collar, for the purpose of drawing down and holding the cover over the mouth of the bottle, so that the said bottle shall be hermetically closed by the cork, or its equivalent, being compressed upon the upper edge of the lip of the same."

166. For an *Improvement in Steam Boilers;* David H. Fowler, New Orleans, La.

Claim.—"The arrangement of the central and exterior flues with the open space and apertures."

167. For an *Improvement in Journal Box Alloys;* John Fidler, New Albany, Indiana.

Claim.—"The composition of the ingredients above named."

168. For an *Improved Wind-Mill;* Marcus Frisbee, Rensselaerville, New York.

Claim.—"The combination of the spring on the sails, with the adjustable or shifting straps, operated by the lever."

169. For an *Improvemnt in Mixing Wheat Flour with Paints;* Isaac Gattman, Philadelphia, Pennsylvania.

Claim.—"The manufacture of paints by grinding crude colors in a composition of water, flour, or its equivalent, rosin, or its equivalent, fish oil, or any drying or undrying oil, in order that the paint thus manufactured may be produced at a cheap rate, and afterwards thinned with water to the required consistency."

170. For an *Improvement in Machines for Softening Leather;* John Greenleaf, Lowell, Massachusetts.

Claim.—"The combination of the blade, with the cylinder and apron carriage, for softening and graining leather."

171. For an *Improvement in Brick Machines;* Joseph A. Hill, Greencastle, Indiana.

Claim.—"The drum provided with the pinion, and arranged to operate relatively with the rock bar and pinion, for the purpose of reciprocating the carriage."

172. For a *Photographic Instrument;* Daniel J. Kellogg, Rochester, New York.

Claim.—"My method of converting the canvass itself into a basin, by means of the metal ring."

173. For an *Improvement in Seed Planters;* B. Kuhns, Dayton, Ohio, and M. J. Hains, Delaware City, Delaware.

Claim.—"The combination of the cell and pocketed roller, with the pocket clearer actuated by the rotation of the roller."

174. For an *Improvement in Saw Gummers;* Samuel J. Lewis and William Alston, Bordentown, New Jersey.

Claim.—"The punch, in combination with the die, the same being arranged in the carriage, so as to rotate and operate together."

175. For an *Improved Portable Fence;* G. R. McIlroy, Oakdale, Indiana.

Claim.—"The supporting the panels on the top of the bases or braces, so as to allow of their being moved sidewise at the bottom sufficient to bring them into a perpendicular position on uneven ground, and securing the same by means of pins or wedges passing between the end batten of each panel immediately above the bottom rail or board through one or a number of holes in the base or cross board at the bottom of the base, which holes are placed in a circle corresponding to that which the bottom of the panel describes by moving it sidewise."

176. For an *Improvement in Excavators;* S. G. L. Morrow, Linn, Missouri.

Claim.—"The arrangement of the cutter elevator, and discharge chute, with the levers regulating the same."

177. For an *Improved Machine for Sawing Marble in Taper Form;* M. M. Manly, South Dorset, Vermont.

Claim.—"A machine for sawing marble in angular or tapering forms, by means of two horizontal saw frames or gates, with adjustable guides run in connexion one above the other, with the saws running and working in one plane."

178. For an *Improved Steam Wagon;* John Percy, Albany, New York.

Claim.—"1st, The two trucks, attached to the underside of the frame, connected by the perch, and turned by means of the rods, which are fitted in the inner ends of the frames of said trucks and connected to the rack, or an equivalent device. 2d, Connecting the axles of the wheels with the connecting rods of the steam cylinders by means of the gearing and cranks. 3d, The arrangement of the trucks, frame, steam cylinders, boilers, and the device for turning and guiding the trucks."

179. For an *Improvement in Machines for Finishing Leather;* Joseph Pyle, Wilmington, Delaware.

Claim—"The combination of the pin block, with its corresponding block, or same as upper block, composed of wood or any malleable metal, the feed rollers composed of like materials, or of wood covered by india rubber cloth, with the corresponding brush rollers, for the purpose of softening leather or skins ready for finishing, or any other materials substantially the same, upon which it will perform the same operation."

180. For an *Improvement in Means for Lubricating the Shear Pin of Ships' Blocks;* John M. Riley, Newark, N. J.

Claim.—"The bands, one or more, interposed between the axis and the eye or band of the pulley, the bands being perforated as shown, and the axis provided with passages or apertures, for the purpose of lubricating the bands and axle."

181. For an *Improved Mode of Attaching Hubs to Axles;* John M. Riley, Newark, New Jersey.

Claim.—"The collars placed upon the arm, in combination with the tube, nut, key, and elastic rings."

182. For an *Improvement in Cultivators;* Luther Robinson, West Cambridge, Mass.

Claim.—"The arrangement consisting of the vertical cutters, horizontal cutter, mould boards, and seed dropper; said parts being placed in relation to each other."

183. For an *Improvement in Locomotives for Roads, &c.;* John Robingson, New Brighton, Pennsylvania.

Claim.—"1st, Combining the sliding bolt by which the sector on the fore truck is locked, with the rotating shaft which carries the gear which operates upon the sector to turn the fore truck, by means of a loose collar and groove, whereby the bolt may be operated by a longitudinal movement of the said shaft. 2d, Fitting the sprocket wheel to the shaft, which drives the fore wheels with a universal joint to enable it to adapt itself to the direction of the driving chain, when the said shaft is not parallel with the engine shaft, and thus to prevent the chain slipping off the wheel, or being twisted or broken."

184. For an *Improvement in Many-wicked Candles;* Benjamin D. Sanders, Holliday's Cove, Virginia.

Claim.—"A candle constructed with three or more wicks, when said wicks are arranged angularly to each other, or in the path of a circle struck from the centre of the candle, at equal distances apart or thereabouts."

185. For an *Improvement in Seed Planters;* John F. Seaman, Walcott, New York.

Claim.—"The shares, arranged so that they may rotate intermittently, in order to free themselves of weeds, grass, or other incumbrances."

186. For an *Improvement in Bridges;* Isaiah Rogers, Cincinnati, Ohio.

Claim.—"1st, The formation of an arch whose voussoirs consist of one or more ranges of tubes in vertical planes, held in position by the described radial plates with confining flanches, the tubes of each component arc being gradually displayed and enlarged from the crown of the arch each way, the enlargement in one direction and the contraction in the other direction, being such as to preserve a circular section throughout, or gradually ovaling from the haunches by a vertical enlargement towards the ends, and a corresponding contraction toward the centre of the arch, according to circumstances. 2d, In combination therewith, the described mode of staying and bracing together the several ranges of such tubular voussoirs."

187. For an *Improvement in Tailors' Measures;* Amos Stocker, Rome, New York.

Claim.—"The instrument, with the arrangement of the eyelet holes, eyelets, and letters."

188. For an *Improvement in Steam Boiler Grates;* Asbury M. Searles, Cincinnati, Ohio.

Claim.—"1st, The conical grate, formed of diverging radial bars, and having the recurved margin or otherwise. 2d, In the described connexion with a conical grate, the radial series of pokers, having the explained shearing action between the grate bars."

189. For an *Improvement in Trunks;* Stephen F. Summers, St. Louis, Missouri.

Claim.—"The inside metallic strips, arranged in combination with the casters."

190. For an *Improved Ore Washer;* Samuel Thomas, Allentown, Pennsylvania.

Claim.—"In combination with a stationary inclined box. the double shafts with spiral flanches thereon, and turning in opposite directions, for lifting up and carrying forward the ores to the delivery."

191. For an *Improvement for Putting Pillows and Bolsters into their Cases;* David B. Tiffany, Xenia, Ohio.

Claim.—"The instrument having the peculiar construction described, for the purpose of inserting pillows and bolsters into their cases."

192. For an *Improvement in Hydro-Carbon Vapor Lamps;* Thomas Varney, San Francisco, California.

Claim.—"The combination of the reservoir by means of a seal pipe, with the stationary vaporizer containing a circuitous passage."

193. For an *Improvement in Furnaces for Zinc White;* Samuel Wetherill, Bethlehem, Pennsylvania.

Claim.—"Making the whole or a portion of the bed of the furnace to vibrate, but this I only claim when the bed is perforated with numerous small holes, and when used in combination with a forced blast of atmospheric air, which passes to the charge of mixed ore and fuel in numerous small forced jets."

194. For an *Improvement in Artificial Legs;* O. D. Wilcox, Easton, Penna.

Claim.—"The employment of the pulley at the knee joint, as a common centre of motion of the elastic cords, for the purpose of producing a natural movement of the artificial limb. Also, the employment of the sack, whether used in this limb or any other."

195. For an *Improvement in Furnaces;* Richard Wells, Baltimore, Maryland.

Claim.—"The introduction of springs between the supporting plates and the fastenings of the tie rods."

196. For an *Improvement in Disconnecting Railroad Cars and applying Brakes;* Joab Buck, Assignor to self, H. S. Buck, J. W. Kimball, and D. H. Thompson, Fitchburgh, Massachusetts.

Claim.—"The combination and arrangement of the shaft, dogs, hooks, and levers, for the purpose of uncoupling whichever car may be last in the train, simultaneously with the application of its brakes."

197. For an *Improvement in Regulating Valves for Steam Engines;* Henry F. Shaw, Assignor to self and George F. Shaw, Woburn, Mass.

Claim.—"The regulating gates as connected with the valve and the governor."

198. For an *Improvement in Machines for Separating Green Corn from the Cob;* Henry Walsh, Assignor to self and M. N. Espy, Philadelphia, Penna.

Claim.—"1st, The screw shaft and spring lever, when the same are used in combination with the stationary block, and the self-adjusting spring block and its cutter, the said blocks holding the cob between them as it is rotated, and at the same time gradually and regularly moved forward by the progressive rotary action of the screw, and so that the said cutter shall also at the same time operate against the lower edges of the grains of corn in succession, and remove them from the cob in a whole or perfect state, or without crushing or otherwise injuring them. 2d, The combination of the ferrule with the pointed screw end of the shaft."

199. For an *Improved use of the Dash-wheel for Washing and Bleaching;* James Wallace, Jr., Glasgow, North Britain; patented in England, June 26th, 1855.

Claim.—"The use of the dash-wheel, in connexion with the use of the chemical ingredients and steam, for the purpose of washing or cleansing textile fabrics and other materials."

ADDITIONAL IMPROVEMENTS.

1. For an *Improvement in Rotary Brick Machines;* George Crangle, Philadelphia, Pennsylvania; patented, June 3, 1856; additional patent, Sept. 9, 1856.

Claim.—"The substitution of the single square toothed ratchet wheel, and the pendulous lever, with its spring, for 'rotating and stopping the cylinders of rotary brick machines.' Also, a single cylinder, with two series of moulds in the same, when the said cylinder is constructed with the partition in the middle, and open at each end; the movable bottoms of the moulds thereof being supported at each of their ends by their rims, which are partially supported by the rollers, whilst the roller and its bearings operate between the said two rims."

2. For an *Improved Fire Arm;* Frederick D. Newbury, Assignor to Richard Varick De Witt, Albany, New York; patented, August 12, 1856; additional patent, September 16, 1856.

Claim.—"1st, The placing the hammer and trigger, with their springs, within the arm. 2d, The cocking of the hammer by the movement of the arm and aid of stud, or its equivalent. 3d, The placing of the tape priming under the barrel and in front of the cone, the same to be brought properly on to the cone by the movement of the arm. 4th, The placing of the tape priming, and operating in combination with the arm."

3. For an *Improvement in Fire Places and Fenders;* John W. Truslow, Lewisburg, Virginia; patented, July 15, 1856; additional patent, September 30, 1856.

Claim.—"The construction of a fire place, wherein recesses are formed in the jambs thereof, with hinged folding and expanding wings or flaps attached thereto, forming a fender and a screen, with the springs, together with the double sliding panels."

RE-ISSUES FOR SEPTEMBER, 1856.

1. For an *Improved Method of Hanging and Straining Reciprocating Saws;* Isaac N. Forester, Centerville, Virginia; patented, October 30, 1855; re-issued, September 2, 1856.

Claim.—"The manner or mode of hanging reciprocating saw-blades, by forming thereon, or by attaching to the ends and front edges thereof, ears or guide flanches, hook clamps, and shank devices, so that the tension or strain and the draft of the blade will be in a direct line, longitudinally through the base of the teeth and front edge of the blade, whereby the whole of the surface or the plate part of the saw blade is left free, unstrained, and divested of all rigidity and stiffness. Also, the adjustable guide plates, with the slotted or grooved gauge pieces."

2. For an *Improvement in Harness Saddles;* John T. Denniston, Lyons, New York; patented, November 20, 1846; re-issued, September 9, 1856.

Claim.—"Making the upper or saddle part of harness saddles of metal, giving the requisite form thereof by moulding, when such saddles are so formed that the leather parts, such as the skirts, can be secured thereto without stitching. Also, forming the upper or saddle part and the under or crotch part in combination, so that the skirt and jockeys are used, and will be embraced between them, and secured."

3. For an *Improvement in Folding Life Boats;* C. Loche, City of New York; patented, January 2, 1855; re-issued, September 16, 1856.

Claim.—"The chain or chains, or their equivalents, as connected and arranged in relation to the stern and stern posts, ribs, and central frame."

4. For an *Improvement in Machinery for Making Hat Bodies;* Charles St. John, Henry A. Burr, Albert H. Wright, and James M. Riblet, Assignees of Henry A. Wells, dec'd., City of New York; patented, April 25, 1846; re-issued, September 30, 1856.

Claim.—"Forming bats of fur fibres, by throwing the fur in properly regulated quantities, against a section of the circumference of a perforated cone, or other form, as the same is rotated to present in succession every part of the circumference thereof to the current of impelled fur, to obtain the required thickness of bat, in combination with the method of holding the fibres on to the cone or other form during the operation."

5. For an *Improvement in Rotary Pumps;* John Broughton, Chicago, Illinois; patented, June 10, 1856; re-issued, September 30, 1856.

Claim.—"The rotary eccentric piston, working within an oscillating barrel, with arrangement of inlet and outlet passages."

DESIGNS FOR SEPTEMBER, 1856.

1. For *Stoves;* Garretson Smith, Henry Brown, and Joseph A. Read, Assignors to Cox, Hagar & Cox, Philadelphia, Pennsylvania; September 16, 1856.

Claim.—"The design, configuration, and arrangement of the ornaments in bas-relief, constituting the design of the stove designated as the 'Gem.'"

2. For *Floor Cloths;* Antoine Glominski, Assignor to Deborah, Albert E. and Nathaniel B. Powers, Lansingburg, New York; September 16, 1856.

Claim.—"The arrangement of ornamental figures, forming a design for floor oil cloths, or other fabrics."

3. For *Parlor Stoves;* Samuel F. Pratt, Boston, Massachusetts, Assignor to W. and J. Treadwell, Perry & Norton, Albany, New York; September 23, 1856.

Claim.—"The construction and arrangement of ornamental figures, forming together the ornamental designs for the plates of a parlor stove."

4. For *Oven Stoves;* Samuel F. Pratt, Boston, Mass., Assignor to W. and J. Treadwell, Perry & Norton, Albany, New York; September 23, 1856.

Claim.—"The combination and arrangemant of ornamental figures and forms, forming together the ornamental design for the plates of a 'Franklin Stove.'"

MECHANICS, PHYSICS, AND CHEMISTRY.

On the Silvering and Gilding of Glass.[*] By J. LIEBIG.

Silvering Glass.—At the request of M. von Steinheil, the author has made some experiments to discover a process for silvering glass *in the cold*, especially with a view to the production of faultless optical mirrors. The silvering fluid, which perfectly fulfils the desired end, is an ammoniacal solution of nitrate of silver, with an addition of caustic potash or soda, which, when mixed with a solution of sugar of milk in water at ordinary temperatures, deposits the silver on the surface of the glass in the form of a mirror.

To prepare the fluid, 10 grms. of fused nitrate of silver are dissolved in 200 cub. centims. of water, and a sufficient amount of liquid ammonia is added to produce a clear solution. This is gradually diluted with 450 cub. centims. of a solution of potash of spec. grav. 1·05, or with the same volume of a solution of soda of 1·035. On the addition of this, a blackish-brown precipitate is usually produced, which must be at once dissolved by a fresh addition of liquid ammonia. The mixture is diluted with so much water as to bring it to 1450 cub. centims. A dilute solution of nitrate of silver is then dropped in until the production of a strong gray precipitate (not turbidity), when the mixture is brought to 1500 cub. centims. by the addition of water. Each cubic centimetre thus contains a little more than 6·66 milligrms. of nitrate of silver, or 4·18 milligrms. of silver. To produce a clean mirror, the fluid should contain no free ammonia, but this must be completely saturated with oxide of silver. For this purpose some of the solution of silver may be kept back and added at the end; and in this case 1 cub. centim. of the solution contains rather less than 4·18 milligrms. of silver.

The solution of potash or soda must be free from chlorides; pure carbonate of soda or potash must be dissolved in water, and rendered caustic by hidrate of lime previously freed from all chloride by washing with distilled water. The solution is not filtered, but left to stand until it becomes perfectly clear.

Immediately before the application of this fluid, it is mixed with one-tenth to one-eighth of its volume of solution of sugar of milk, containing 1 part in 10 parts of water.

In silvering small concave or convex mirrors, a stick or brass hook is attached to the back of the glass by a resinous cement, so as to enable the glass to be suspended horizontally. It is suspended over a suitable glass or porcelain saucer, with the surface to be silvered about half an inch from the bottom of the vessel, and the fluid previously mixed with the solution of sugar of milk is poured in until the whole surface of the glass is immersed.

For the production of flat mirrors the author recommends vessels of gutta percha, cut out of a flat piece, so as to have a margin of about an inch all round the glass. This is turned up after the gutta percha has been softened in hot water, and the corners are made water-tight by the application of a hot spatula or knife. The glass is supported at a distance of half an inch from the bottom of the vessel, by means of small cones of gutta percha at the corners, and the space between the surface of the glass and the bottom is then filled with the silvering fluid. The author admits that these arrangements are very imperfect, and that many improvements might be introduced, but the glass should always be suspended at the surface of the fluid.

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[*] From the Lond. Chem. Gaz., No. 327.

The reduction of the silver takes place instantly upon the mixture of the alkaline solution of silver with the sugar of milk; the mixture immediately acquires a dark color. In a few minutes the glass plate appears black; in a quarter of an hour it becomes bright, and the reduction is complete when the fluid between the edge of the glass and the wall of the vessel is covered with a white specular coat of silver. Of course the whole of the silver in the solution is precipitated, and only a very small portion of it goes to form the mirror. The quantity of silver attached to a surface of 226 square centims. was 49 milligrms. The silvering of a mirror of 1 metre square would consequently take 2·210 grms. of silver. The quantity of fluid required to silver a glass of 226 square centims. was 280 cub. centims., containing 1170 milligrms. of silver, so that 1170—49=1121 milligrms. of silver are thrown down in the fluid and on the walls of the vessel; this must be collected, and again converted into nitrate of silver, and some loss is unavoidable.

When silvered, the glass plate is taken out of the fluid, washed with warm distilled water, and dried in a warm place. Care must be taken in removing and washing the plate, not to injure the silver coat with the fingers, as otherwise the water penetrates by capillary attraction through the injured spot, and separates the coat of silver from the glass. When dried, the silver adheres so strongly to the glass that it can hardly be rubbed off with the finger. It forms a very beautiful, somewhat opalescent mirror, which may be converted into a perfect silver mirror, by careful polishing with fine rouge and velvet. A good deal depends on the cleaning of the glass in the production of perfect mirrors.

The distance between the bottom of the vessel and the surface of the glass must be exactly equal throughout, as otherwise the thickness of the coat of silver will be unequal, and the places where it is thinnest will appear darker than the rest. The smallest bubble of air also will cause a small vacancy in the coating, and the author has found it advantageous to moisten the surface of the glass in the first place with alcohol, as this displaces the adherent stratum of air more readily than water.

When placed at the bottom of the vessel the glass plate is just as completely coated, but the whole of the silver in the solution is precipitated upon it in the form of a gray powder, which adheres so strongly that it can only be got rid of by mechanical means, which endanger the mirror itself. The cost is also greatly increased.

Before putting it in a frame, the dry mirror is warmed a little, and coated with a thin colorless varnish. For this purpose a solution of dammara resin in alcohol is very good.

Gilding of Glass.—Glass can only be permanently and brilliantly gilt with the assistance of heat. Gilding effected in the cold is of beautiful color and lustre, but does not adhere, and detaches itself from the glass by washing with water.

The gilding fluid is prepared by dissolving pure gold in nitromuriatic acid, adding 292 milligrms. of chloride of sodium to the solution for every gramme of gold, evaporating to dryness, and heating the residue until all free acid is driven off. The double salt is then dissolved in water, and water is added until each 100 cub. centims. of fluid contains exactly 1 grm. of gold. 50 cub. centims. of this solution are mixed with 20 cub. centims. of a solution of soda of spec. grav. 1·035, and 300 cub. centims. of water in a glass flask, and boiled until it is reduced to 250 cub. centims.; and another 50 cub. centims. of the solution, mixed with 20 cub. centims. of the same solution of soda and 230 cub. centims. of water, are kept for an hour in boiling water. The two fluids are then mixed together, and must be employed in gilding whilst fresh.

To gild the inside of a glass vessel, a tenth part of its volume of a mixture of 2 parts of alcohol and 1 part of ether is poured into it, and it is then filled up with the hot gold solution. The vessel is then set in water, the temperature of which must not rise above 176° F. In from ten to fifteen minutes its inner surface is covered with a brilliant golden film, and the vessel is removed from the water when its walls are opaque, or exhibit a deep green color by transmitted light.

The alkaline solution of gold is of course always reduced by the alcohol, but the glass only acquires its brilliant golden coat when the fluid is of such a nature that the adhesion of the gold to the glass may be somewhat stronger than that to the water; in the former case the gold is precipitated only on the glass, in the latter only in the fluid. It is very difficult to hit this point exactly, and the smallest error in the mixture renders success impossible. The author adds, that he has obtained the most beautiful gilding by this means, whilst in other cases he has failed entirely, without being able to discover the cause, so that he does not think this method will be of general application. The mixture will only act whilst fresh, when it has a very slight yellowish tinge; by standing it becomes colorless. Alcohol reduces the gold from the colorless fluid with difficulty.—*Liebig's Annalen*, April, 1856, p. 132.

The English journals contain a notice of another method of silvering by M. Petitjean, upon which Prof. Faraday has been lecturing at the Royal Institution. The following very judicious remarks by the Editor of *Newton's London Journal of Arts and Sciences*, indicate the true source of failure in all the various modes which have been patented for silvering glass: Ed. Journ. F. I.

There seem, indeed, two errors of the most fatal kind involved in any attempt to unite silver to glass in a continuous coating, even if the bond of union could be made much more powerful than the present mere attraction of cohesion. In the first place, silver is one of the best conductors of heat, and glass one of the worst; and in the second place, silver expands by the action of heat more than almost any other substance, and glass less than almost any other substance. To think of keeping two such natural opposites in absolute contact under varying conditions of temperature, is therefore futile: as well might one strive to prevent a soldered bar of silver and platinum from bending, under the same circumstances. When cold is applied to such a combination, the silver must contract more than the glass, and one of two consequences will ensue;—either the glass must bend, or the thin film of silver give way; and this latter result commonly takes place, until the coating in the end becomes broken up into small spangles, and the power of correct optical reflection is lost: hence the use of these silvering processes has been retained within the limits of simple decoration upon small ornamental objects, and there it is likely to rest.

Some persons may indeed imagine that the same objection would apply to any continuous metallic coating, and therefore the ordinary amalgam of tin and mercury must be liable to the same defects: but in reality there is no analogy between the two cases, inasmuch as that the amalgam in question consists, from the moment of its application, of an immense number of crystalline scales of a metallic alloy, the interstices of which are filled with mercury, whose fluidity permits of a free movement of the scales, without for one moment breaking the continuity of the reflecting surface. If heat be applied, the edges of these scales glide over each other like those of a fish, whereas, under the influence of cold, they separate, and the intervening spaces are immediately filled with fluid mercury, in obedience to the law of capillary attraction—the metallic coating remaining perfect under both circumstances: we do not, therefore, expect to see the use of mercury abandoned for that of silver, in the construction of ordinary looking-glasses, how cheap soever the latter process may become.

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*The Gums and Resins of Commerce.** By P. L. Simmonds.

(Continued from page 283.)

East Indian Gum Kino.—This, one of the most useful indigenous gum resins of the East, is the produce of the *Pterocarpus marsupium*, Roxburgh. The gum flows out on longitudinal incisions being made in the bark, which being fleshy and very thick, is easily done. It trickles down in a tenacious semi-fluid form, and is collected in a cocoa nut shell. On exposure to the sun in flat plates, it soon hardens into angular brittle shining fragments, of a bright ruby color, highly astringent, and readily soluble in hot water. The gum changes into a blood red color by alkalies, which, however, destroy its astringent properties. It is precipitated by the salts of iron, silver, lead, &c., and, with sulphate of iron, forms a fine ink. It dissolves readily in water, to which it imparts its own beautiful color.

Another variety of Indian kino exudes during the hot weather from natural fissures and wounds in the bark of the *Butea frondosa*, a very common leguminous tree. It is known in commerce by the name of Bengal kino, or gum butea, being closely allied to the kino of Pterocarpus, in its chemical and medicinal properties. The natives of India use it for tanning, but as it imparts to the leather a red color, it is con-

*From the Journal of the Society of Arts, Lond., November, 1855.

sidered objectionable by European tanners. Kino is commonly used in medicine for its astringent properties, especially in diarrhœa, chronic dysentery, and other such cases.

Amber.—The source of amber was long uncertain; by some it was considered a carbonaceous mineral, but it is now universally supposed to be a vegetable resin, the product probably of a Pinus. It is too well known in appearance to need description. It has several commercial uses. Being commonly translucent, and susceptible of a good polish, it is made into ornaments as necklaces. It is the base of an excellent varnish, and the source of succinic acid, which is employed in chemical investigations. The beautiful black varnish used by coach-makers, is a very carefully prepared compound of amber, asphaltum, linseed oil, and oil of turpentine. Amber often contains insects, flies, ants, spiders, &c., some of which are so delicately formed that they could not have occurred except in a fluid mass, such as a volatile oil or natural balsam. Mr. Wallis, of Longacre, has one of the largest and most interesting collections of these fossil insects I remember to have seen, and they occur not only in amber, but occasionally in the courbaril resin of South America, in copal and anime, and in copal from Accra. In its appearance and physical properties, amber strongly resembles copal, which is often fraudulently sold for it in the Indian bazaars.

We derive our chief supplies from Prussia, where it is thrown up on the coast between Konigsberg and Memel. The imports in the last few years have averaged about 40 cwts. yearly. Large deposits of amber were found a few years ago in some lakes on the eastern coast of Courland, not far from the Gulf of Riga; and in January, 1854, a bed of yellow amber, apparently of great extent, was found on sinking a well at Prague, from which pieces weighing two and three pounds were extracted. The largest block known is in the Royal Cabinet at Berlin, and weighs thirteen pounds.

This fossil is also found in Madagascar, in Japan, on the shores of the Indian Archipelago, and in small quantities on the coast of China. It forms a considerable item of import in the Chinese ports, the greater portion coming from the eastern coast of Africa; its value there formerly was very great as an incense and for ornaments. Transparent yellow pieces are considered the best, and the price in the East, as here, varies according to size and quality; for its color ranges from black and yellow through red and white. A resin called false amber—no doubt a copal—is among the exports from Calcutta to Great Britain to the extent of several tons.

Lac.—This important resinous substance, which comes into our ports from the East Indies in various form, to the extent now of 2500 tons per annum, is obtained from the incrustations made by an insect (*coccus lacca*), similar to the cochineal insect on the branches and twigs of many trees in India, as *Vatica laccifera*, *Butea frondosa*, *Inga dulcis*, *Feronia elephantum*, *Erythrina indica*, *Schleichera trijuga*, &c. The lac is formed by the insect into cells, somewhat resembling a honeycomb, in which the insect is generally found entire, and owing to whose presence stick lac yields by proper treatment a red dye, nearly, if not quite, as bright as that obtained from cochineal, and more permanent.

Lac is found encircling the branches of these trees in the form of a tube, (half an inch to one inch in diameter;) the broken branches, with incrustations at various distances, is called in commerce stick lac, which ought to be semi-transparent. The coloring matter, exhibited by grinding stick lac, and then treating it with water, constitutes seed lac. I have on the table specimens in the various forms, of the crude stick lac attached to branches of various trees, seed lac, lump lac, shellac, thin plates of a yellowish and brown color, known as button lac, thread lac, and bleached or white lac of the shops.

The range of production of this resin is very extended, reaching from Bombay to the Eastern Archipelago, Ganjam, Nepaul, Burmah, the jungles of the Malay Peninsula, and those of Southern India. In the latter district it is not much collected for commercial puposes, although always procurable in the bazaars. The best lac is produced there upon the *Schleichera trijuga*, or cosumb tree, which abounds in the Central Provinces, and yields the coloring matter twice a year. Burt lac is produced in the Rajpootana states, on the *Ficus indica* and *religiosa*, *Zizyphus jujuba*, and *Acacia concinna*.

The resin in stick lac constitutes about 68 per cent.; in seed lac 88 per cent.; and in shellac, 91 per cent. The wax, which forms about 5 or 6 per cent., is analogous to myrtle wax.

Our imports from India in the last twenty years have been :—

Years.	Shellac.	Seed-lac.	Stick lac.	Lac-dye.
	Cwt.	Cwt.	Cwt.	Cwt.
1833	7,784		1,439	2,919
1841	29,056		2,340	10,905
1843	27,790		733	10,700
1844	14,873		1,194	7,636
1845	22,471		187	12,846
1846	9,449	418	293	5,541
1847	8,637	1,953	622	7,418
1848	14,362	34	358	4,449
1849	14,786	60	2,695	13,546
1850	20,245	1,524	9,189	17,930
1851	19,745	3,821	5,317	17,922
1852	16,356	934	3,054	17,139
1853	28,512	402		17,674

Exports from Calcutta. Twelve months ending 31st August, respectively :—

	1855.	1854.	1853.
SHELLAC :—	Ind. Maunds.	Ind. Maunds.	Ind. Maunds.
To Great Britain, . .	26,147	20,659	42,321
To France, ...	8,609	5,951	11,324
To North America, . .	124,630	21,103	11,290
	158,786	47,713	64,945
LAC-DYE :—			
To Great Britain, . . .	13,177	23,323	25,776
To France, ...	1,152	510	3,141
To North America, . .	5,884	799	7,745
	20,213	24,632	36,662

A resinous gum called Alkor Lek (whence the word lac), flows from the *Pistacia Terebinthus*, Linn., in Algeria, which, mixed with other ingredients, is given as a purgative for fowls. It is supposed that this tree would yield good terebinthine. The gum flows so abundantly, even without incision, that it is often dangerous to sleep under the trees.

Under the commercial name of Dragon's Blood, the produce of several species of Dracæna, is imported to the extent of about 100 packages of 1 to 2 cwts. each. In commerce the resin occurs in powder, grains, masses, drops of the size of an olive, and in sticks enveloped in the leaf of the talipot palm. Its chief use is for coloring artificial tortoise-shell and in paints, varnishes, sealing-wax, &c. It stains marble, especially if the stone be heated. The resin is used occasionally in medicine as a tonic and astringent, and also in opiates and dentrifices. Occasionally a brick red powder, known in the East as wurrus, has been passed off here for dragon's blood. This is collected from the seed-vessels of a euphorbiaceous tree, the *Rottlera tinctoria* of Roxburgh, occurring in Arabia, Eastern Africa, and various parts of India. The Chinese esteem dragon's blood highly. It is obtained in Socotra from the *Dracæna draco*, which is usually met with on the hills at the elevation of 800 to 2000 feet above the level of the sea. There are two kinds there, and the best is of a dark crimson color. Jacquin states that the lump dragon's blood is the produce of *Pterocarpus draco*, but this is very questionable. A common kind in the eastern bazaars is the produce of the red astringent fleshy fruit of the *Calamus draco*, or by incisions in the stem, or natural exudations from various parts of the plant. An inferior kind is obtained by boiling the fruits. In the Madras bazaars, dragon's blood ranges in price from £3 to £11 the maund of 82 lbs., according to quality.

Dragon's blood was the cinnabar of the ancient Greeks. In the time of Dioscorides the opinion prevailed that it was the indurated blood of a dragon; and other old authors tell us that the tree received its name from having the figure of a dragon upon the fruit.

A red juice flows from the wild nutmeg on incisions being made into the bark. This hardens into laminated resinous pieces, red and transparent, and forms a variety of the substance known in commerce under the name of dragon's blood. Professor Lindley states, on the authority of Erdlicher, that a species of Myristica, of the Philippines, yields a crimson juice, which is collected from incisions in the trunk, and used as a substitute for dragon's blood, under the name of Durgan.

Gum Guiacum of commerce. This solid and very friable resin, of which a few tons come in yearly, is the produce of the Lignum vitæ tree of the West Indies (*Guiacum officinale*). The color of the resin is yellowish brown, but it becomes green on exposure to light. It is chiefly used medicinally in gout, chronic rheumatism, &c.

The wood being very hard and heavy, is extensively used for making pestles, rulers, and skittle-balls, and various other articles of turnery-ware. The resin exudes naturally from the stem of the tree, and may be seen in all seasons of the year. It is obtained most copiously by wounding the tree, which is usually done in May. Another method is by heat. The trunk and larger limbs being sawn into billets of about three feet long, an angular hole is bored lengthwise in each, and one end of the billet so placed on a fire that a calabash may receive the melted resin, which runs through the hole as the wood burns. It is also obtained in small quantities by boiling chips, or shavings of wood, in water with common salt. The resin swims at the top, and may be skimmed off.

In the early part of this century we used to receive this resin from Portobello, whence 22 tons were shipped in 1801; now we get it chiefly from St. Domingo and Jamaica. We received from Hayti 54 cwt. in 1849, 447 cwt. in 1850, 78 cwt. in 1851, and 5 cwt. in 1852. It is not in large demand.

The Icica tribe, lofty trees of South America, produce resinous exudations of value in the districts where the trees occur. Of these I have specimens here in the Carana and Tacamahaca resins; and the resin of Perama, another dark resin from Central America. The *Icica Icicariba* or *Amyris elemifera*, produces elemi, which resembles olibanum closely in its properties and uses.

In Demerara, Jamaica, and other quarters, a gum resin, similar to the gum anime of commerce, exudes from the lowest roots of the simiri or locust tree (*Hymenæa Courbaril*) in a vertical direction, in columns or pieces upwards of a foot in length. It may also be obtained by tapping the tree, when in the course of a few days a large solid mass is formed. It forms an excellent varnish, superior to Chinese lac, and is used for the same purposes as copal. It may be obtained in various parts of British Guiana in great abundance. Some was shown at the French Exhibition, of which I have a sample here. It is of a bright color, with a brittle fracture, and is not unlike anime. A courbaril resin from French Guiana was also shown, which was of a bright lemon color, but much coated. A scraped copal from the same quarter, appears to be a good useful resin.

It is very satisfactory to find our colonies and foreign possessions drawing forth their latent energies in so highly creditable a manner. The admirable collection of raw products shown at Paris by the Island of Jamaica, and fitly rewarded with a gold medal, is an evidence of the talent, exertions, and activity displayed by the members of the kindred Society of Arts in that Island. Demerara, Madras, and New South Wales have also made excellent displays, and achieved much for the interests of commerce, science, and the arts.

FRAGRANT INCENSES.—A common use, and one of great antiquity, for many of the fragrant resins, is for odoriferous incenses in temples, &c.

In the East we have the gum Benjamin (the most costly), olibanum (the ancient frankincense), myrrhs, true and false, as the googul, the muthipaul, the doopada resin, and poona rumpoly from a species of Boswellia. What is chiefly sold as common frankincense in our shops is gum Thus. In Trinidad, incense is obtained from the *Trichilia trinitensis*, but the list of fragrant and balsamic resins might be widely extended, and it will suffice to notice a few of the most important commercial resins of this class.

GUM BENJAMIN—or Benzoin, of commerce, is said to be the produce of the *Styrax Benzoin*, a lofty tree, which grows in Siam, Sumatra, and Java; but, according to some accounts, it would seem to be also obtained from a smaller tree, cultivated in Borneo. The best balsam is obtained in Siam by incisions made in the trunk of the tree, after it has attained the age of five or six years. The resin is white and transparent at first. About three pounds are given by each tree for about six years. It forms an article of export from Siam. From Singapore, the exports in 1852 were to the extent of 1282 piculs, and 168 piculs in 1853. Java imported last year Benjamin of the value of 176,182 florins. The different varieties bear a price proportioned to their goodness; the finest quality used to range from £10 to £20 per picul of 133 lbs. Benzoin is the frankincense of the far East, and has long been used for incenses in the Roman Catholic, the Hindu, Mahomedan, and Budhistic temples, and probably in the Israelitish worship. Wealthy Chinese fumigate their houses with its grateful odor. Olibanum, which is cheaper, is in similar and more general use in other parts of the East Indies.

The Gum Olibanum of commerce, is the frankincense of the ancients and the luban of the Arabs. In India it is obtained from several species of Boswellia, *serrata*, *thurifera*, and *glabra*. No botanical description appears to have been published of the African tree, although Capt. Kempthorne, Major Harris, and other travelers, furnish some general accounts of it. The tree invariably grows from the bare and smooth sides of the white marble rocks, or from isolated blocks of the same, scattered over the plain without any soil whatever. On making a deep incision into the trunk, the resin exudes profusely, of the color and consistence of milk, but hardening into a mass by exposure to the air. The young trees produce the best and most valuable gum, the older merely yielding a clear glutinous fluid resembling copal, and exhaling a strong resinous odor.

Olibanum was formerly in high repute as a sovereign remedy against inflammation of the eyes, and as an efficacious remedy in consumption. It was also commonly drank as a stimulant in wine. But for all these purposes it has long gone out of use, and is chiefly imported here for re-shipment to the Continent, being bought up by the Greek merchants.

The trees that produce the luban or frankincense are of two kinds, viz: the luban meyeti and the luban bedowi. Of these the meyeti, which grows out of the naked rock, is the more valuable, and when clean picked and of good quality, it is sold by the merchants on the coast for 1¼ dol. per frasila of 20 lbs. The luban bedowi of the best quality is sold for one dollar per frasila. Of both kinds the palest color is preferred. The trees vary greatly in height, but are never above 20 feet, with a stem of nine inches in diameter. Their form is very graceful, and when springing from a mass of marble on the brink of a precipice, their appearance is especially picturesque.

Although the Wursungili range and other mountainous tracts afford an inexhaustible supply of frankincense, it is a mistake to suppose that elevated districts produce the best gum.

Lieut. Cruttenden, in his journey among the Edoor tribes, states that the gum of the large leaf kind of frankincense tree is not much prized. He noticed in his travels many other kinds of gum trees, for which he could find no name, and one of these he considered to be the gum elemi.

The quantity of gum of all kinds annually exported on an average from the Somali country, on the north-east point of Africa to India and the Red Sea, may be stated at 1500 tons.

The wild gum trees in many districts are considered family property, like the date palms in other parts of Africa. Sometimes the young gum trees are transplanted, and thus cultivated they thrive well, and produce largely.

Major Harris describes the Myrrh tree (*Balsamodendron myrrha*,) as growing abundantly on the Abyssinian coast of the Red Sea to the Straits of Bab-el-Mandal, over all the barren hill sides of the low zone inhabited by the Danakil or Adaril tribes. It is called Kurbeta, and there exists two varieties; one (producing the better description of the gum,) being a dwarf shrub with deeply serrated crisp leaves of a dull green, while the other, which yields a substance more like balm than myrrh, attains a height of ten feet, and has bright shining slightly dentated leaves. The myrrh, called Hofali, flows freely from any wound in the form of a milky juice, possessing a perceptible acridity, which either evaporates or becomes chemically changed during the formation of the gum. The seasons for collecting it are in January, when the buds appear after the first rain, and in March, when the seeds are ripe.

Every passer-by transfers such portions of it as he may find to the hollow boss of his shield, and exchanges it for a handful of tobacco with the next slave-dealer whom he meets on the caravan-route. The merchants also of the sea coast, before returning from Abyssinia, send into the forests that gird the western bank of the river Hawash, and bring away considerable quantites of the *Hofali*, which is sold at a high price. The natives administer it to their horses in cases of fatigue and exhaustion. (*Trans. Linn. Soc.*)

Cedar Gum (*Widdringtonia junipercides*, Endl).—From the various branches and cones of the cedar tree of the Cape Colony, exudes a gum which soon hardens in the air, becomes solid, yellowish, and transparent, and scarcely differs from the gum olibanum of commerce. This cedar gum is locally used for various medicinal purposes, for compounding plasters and preparing varnish.

Bdellium, or false myrrh, is believed to be the produce of *Commiphora Madagascarensis* of Lindley—the *Amyris commiphora* of Roxborough. Googul is the common name for it in India. The gum resin is semi-pellucid and more yellow than myrrh, and a fragrant balsamic resin is also obtained from the tree.

The Doopada resin, or East Indian copal, exuding from the *Vateria Indica* in Mysore, Canara, and Malabar, &c., is used as a fragrant incense in the temples; the quantity procurable is very considerable. Muthipal, the resinous exudation of *Ailantus Malabaricus*, Decandolle, is said to be used as an incense in Cochin and Travancore. A very fragrant gum, the Hyawa, or incense, suitable for pastiles and similar porposes, is also obtained from the *Icica heptaphylla* of Aubl.

The shrub which produces the balsam of Mecca (*Balsamodendron opobalsamum*) is found, according to Major Harris, on the Arabian Coast at Cape Aden, where it is called Beshan, either the original of, or a derivative from, the word balsam. It is the *Balessan* of Bruce, who did not meet with the true myrrh tree. The balsam flows copiously from incision, and the ethereal oil speedily evaporating, a tasteless gum remains.

Balsams.—When in their semi-fluid state, owing to the volatile oil they contain, resins are termed balsams, and the most important commercial balsams are Turpentine (already noticed), Copaiba, Tolu, Peru, and Canada balsams, Styrax or Opobalsamum, and China varnish. The oleo resins are chiefly used as sources of the volatile oils and Gum resins in medicine. An aromatic oil, called oil of gum kikekunemale, is, according to some authors, obtained from a species of copal in the East.

Camphorwood-oil, obtained from *Dryobalanops camphora*, is used largely in Singapore as a substitute for turpentine, and sells at from 7d. to 10d. a bottle. I have several specimens here of the oils extracted from different resins with which Mr. Wallis has obliged me. A bituminous oil, obtained in the volcanic regions of the islands of the Eastern Archipelago, is shipped to Holland, and when distilled furnishes petroleum.

The balsam of capivi is obtained chiefly from *Copaifera guianensis* and *officianalis*, natives of South America and the West Indies. The imports from Brazil in the last five years have averaged 570 cwt.

Storax, copal, and other gums, may be obtained in large quantities from the Indians in the interior regions of South America, and at prices merely nominal. The Balsam of Peru is imported to the extent of five or six tons per annum, being obtained from *Myroxylon peruiferum.* It is, however, obtained in Central America, and not in South America. Twenty-six cases of East India balsam were imported in September from Moulmein. The balsam exudes so abundantly at the proper season from incisions in the stem of the tree that 12 lbs. are frequently obtained in the space of three or four hours. The balsam of tolu is another oleo resin imported to the extent of a few tons from South America. It is used in medicine, and as a flavoring ingredient by confectioners and perfumers. It is the produce of *Myrospermum toluiferum.* Liquid amber, or styrax, is another balsam of commerce of small consumption. Styrax Benzoin, or storax, in tears from Amboyna, from *Styrax officinale*, is a powerful and fragrant balsam, recently imported from the East. It formerly fetched a very high price.

Canada Balsam.—This well known fir balsam is procured from the American silver fir (*Abies balsamifera*). It is naturally deposited in vesicles on the trunk and limbs, and is collected by bursting these tumors and receiving their contents in a shell or cup. The fresh turpentine thus obtained is a greenish, transparent fluid, of an acrid, penetrating taste ; it is highly celebrated here for medicinal and other purposes, and is generally designated in England " Canada Balsam." It makes a very fine transparent varnish for water-color paintings, which does not become darker with time, and is much used in wax flower making.

Muscat is a great entrepôt for the collection of gums for re-distribution. About 15,000 to 16,000 maunds of asafœtida are imparted there annually from Persia in Arab vessels, the greater part of which is re-exported to India.

Four thousand maunds of aloes from Socotra, and some of an inferior quality from Mocha and Macula, are also received for re-shipment to India, and 3000 to 4000 maunds of gum ammoniacum from Persia intended for Bombay. The maund is about 28 lbs.

Gum copal is imported from Zanzibar, and some quantities of frankincense, gum galbanum, and gum from Persia and Bassora.

Asphalte is manufactured at home by one or two companies to the extent of two or three thousand tons per annum. Small imports are received from America and the Continent for the use of varnish-makers, but as it does not appear in the trade returns, it is probably included with pitch, of which we receive about 300 or 350 tons yearly. But little of the genuine Egyptian asphalte is now to be met with. There is one prolific source of asphaltum from which little commercial benefit has yet been derived, at least to the extent to which it is susceptible, and that is the Pitch Lake of Trinidad, covering a surface of about a mile in length by an eighth in width. Though the surface is generally too fine to receive a foot-print—just hard enough to cut readily with an axe—there are places where the pitch oozes out in nearly a liquid form. But the pitch is not confined to this locality. There are masses of it extending wider inland, and in several points it reaches to the sea-beach, whence it is shipped in large quantities to America, and some of the West India Islands, to use in building and flagging streets. Near the Lake some of the negroes occupy themselves in boiling down the pitch, some of which is shipped in a pure state, and some, with the addition of lime, exported as mastic. Many hundreds of tons have been thus taken from the lake, to the depth of about a foot below the surface. The hole is always filled again within two days after the cutting, by the upheaving of the mass. It appears as though billions of tons of pitch had boiled up from the bowels of the earth, from the effects of an immense subterraneous fire, which had been extinguished, and left the asphaltum to cool in enormous bubbles.

Various attempts have been made to apply the inexhaustable store of bitumen afforded by this lake to some useful purpose. It is the best substitute for macadamization yet discovered. Mixed with sand and pebbles it is much used for pavements and the ground floors of houses at the town of Port-au-Spain, a purpose for which it is admirably adapted. The late Sir Ralph Woodford, when governor of the island, tried to obtain carburetted hydrogen gas from it to light a beacon on the tower of Trinity Church. It burnt well, but created such an intolerable stench, that the experiment was obliged to be abandoned. The person entrusted with the trial, however, knew nothing of chemistry. It has been employed to advantage as fuel by the American steamers plying on the Orinoco. It is thrown in the furnace among the wood, fusing too readily to be used alone.

With ten per cent. of resin oil it forms an excellent pitch for vessels. It was used for this purpose so far back as 1593, by Sir Walter Raleigh, who tells us that this substance was then in general use by the various tribes of Indians in the river Orinoco for caulking their canoes. It has been recently coming into use in the manufacture of petroleum. It might, I should suppose, form a base for some of the compressed artificial fuels.

The Earl of Dundonald has long had great faith in its ultimate commercial utility. Twenty or thirty years ago he shipped two cargoes of it to England, but it was found then to require too much oil in order to render it useful. Lately his lordship has purchased a large tract of the pitch lands, including twenty-six acres of the lake, and has instituted various experiments with the view of substituting the bitumen for India rubber and gutta-percha in the manufacture of water-proof fabrics, covering of telegraph wires, &c. Judging from the specimens of those shown by his agent at Port-of-Spain (Mr. C. F. Stolmeyer), these efforts bid fair to be quite successful. It seems only necessary that the same amount of intelligent enterprise should be directed to the subject in order to render this wonderful reservoir of bitumen a source of great individual profit and of essential service to mankind. If it could be brought into extensive commercial use for pavements and for the ordinary purposes of pitch and tar, Trinidad could easily furnish supplies for the whole world. Persons desirous of information connected with this lake will find good accounts in the *United Service Journal* for January, 1839, by Dr. Thomas Anderson; in Martin's "West Indies," vol. i. p. 191; by Mr. Alex. Anderson, quoted in M'Callum's "Travels in Trinidad," originally given, I believe, in "Transactions of the Royal Society," vol. lxxix. p. 65, and in *Fisher's Colonial Magazine*, vol. iii. p. 43 and 426. The most recent and best account will be met with in a paper by Mr. N. S. Manross, in *Silliman's American Journal of Science and Art*, vol. xx. p. 153 (No. for September, 1855).

(To be Continued.)

Description of a Spiral Coil Piston-Packing.[*] By Mr. David Joy, of Worcester.

[Read before the Institution of Mechanical Engineers.]

The piston-packing, which is the subject of the present paper, was designed by the writer to carry out the principle, which appears to him the correct one, for producing steam tightness with the least loss of power from friction and the greatest economy in repairs, namely, by the use of metal in that form in which it will give out the greatest amount of continuous elasticity, that is, by employing a spring acting through a lengthened space with comparatively slight intensity of pressure, instead of the short and rigid spring or series of springs commonly used in packing metallic pistons.

The piston in which this packing is used is shown in Figs. 1, 2, and 3, and consists of a simple block, into which the rod is screwed and pinned. The periphery of the piston being turned to $\frac{1}{16}$th inch less diameter than the cylinder, a recess is cut in it with a half inch pitch, making 3 inch more than two revolutions, as shown in Fig. 2.

The packing is formed out of a cast iron or brass ring, $\frac{5}{8}$ths inch thick, and $\frac{3}{4}$ths inch larger in diameter than the cylinder. The ring is turned and bored, and being placed on a mandrill, a spiral groove is cut in it with a $\frac{1}{8}$th inch tool, set at $\frac{5}{8}$ths inch pitch, as shown by the dotted lines. This cut being carried through, leaves the ring in the form of a spiral coil of half inch by $\frac{5}{8}$ths inch section, and of about five full revolutions. A portion of this spiral is cut off, equal to two revolutions and $\frac{3}{4}$ths inch over. This is threaded on to the block-piston, and pushed down till it

[*] From the Lond. Artizan, June, 1856.

drops into the recess, which it exactly fills laterally, as shown in Fig. 3. A sheet iron cramp is placed round the packing, by which it is compressed to the diameter of the piston, which is then placed at the mouth of the cylinder, the ports being protected by small blocks of wood, and the piston is then thrust from the cramp into the cylinder.

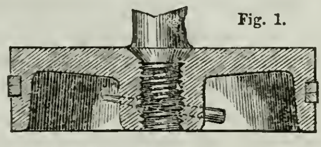

Fig. 1.

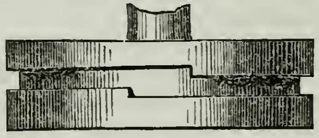

Fig. 2.

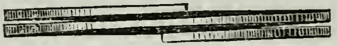

Fig. 3.

The objects aimed at in this modification of packing are to avoid friction by obtaining an elasticity as light as possible, yet sufficient to produce perfect contact with the face of the cylinder to insure steam tightness, and sufficiently continuous to follow up the effects of wear without the necessity of frequent renewal by resetting. And this the writer finds is best accomplished by using a packing which shall consist of the greatest possible length in proportion to its cross-sectional area. No figure meets this requirement so fully as the spiral coil, and the number of coils, or length of packing, can be increased to any extent that may be found advantageous, the elastic action being always in one continuous length.

As the coil fits throughout its length between the parallel sides of the recess in the piston, its two extremities may recede from each other to any distance that may be found requisite for wearing out the rings without at any time exposing an opening for the passage of steam. The packing under all circumstances fills the recess, except at the bottom, where the vacant spaces at the extremities of the ring, left in the uncoiling of the ring by wear, are effectually closed by the piston body sliding in contact with the cylinder, that part of the packing ring being placed at the bottom side of the piston for this purpose. By experiments it has been found that with the 16 inch brass packing, with half inch elasticity of compression on the diameter, and half inch square section of packing, the pressure on 53 sq. in. of surface of packing was 1·92 lbs. per sq. in., or 102 lbs. on the whole packing. It took 65 lbs. to move this piston backwards and forwards in the cylinder, when disconnected from the rest of the machinery and the glands unpacked, equal to 0·32, or about $\frac{1}{3}$d lb. per sq. in. on the surface of the piston. The 16 inch cast iron packing with $\frac{5}{8}$ths in. elasticity of compression on the diameter, and half in. by $\frac{5}{8}$ths in. section of packing, gave a pressure of 4·41 lbs. per sq. in. of surface of packing, and took 135 lbs. to move it in the cylinder as above, being 0·67, or about $\frac{2}{3}$ds lb. per sq. in. on the piston. This experiment was made immediately after the engine had done her day's work, when the cylinder lids were taken off, and the glands unpacked for the purpose. Previously to unpacking the glands, the steam at 110 lbs. pressure was put on behind the pistons with a most satisfactory result, there being no appreciable leakage of steam past the piston. A similar trial has frequently been made by merely opening the cylinder cocks, and putting steam on behind the piston, when no appreciable blow is observable.

A corresponding experiment was also tried with a 16 inch piston of the ordinary class, having cast iron V packings, and it was found to require 426 lbs. to draw the piston slowly along the cylinder, when disconnected as in the other experiment, showing more than three times the resistance.

The new packing avoids the frequent necessity for "looking at" the piston, which is so large an item in the expenditure of locomotive running sheds, and this is in a great measure a consequence of the accomplishment of the former object, as the large amount of elasticity resident in the coil will wear out the packing without the necessity of examination for renewing that elasticity by means of resetting the springs, as in ordinary pistons.

This piston has also the advantages of simplicity of construction and freedom from parts liable to get loose, and produce breakage of pistons and cylinders. As this packing is used in a block piston, it does away with the necessity for lids, nuts, screws, guards, &c., and reduces the piston to its fewest possible number of parts—the rod, the piston, and the split pin to secure the rod to the piston. The packing-ring also being always confined in a recess of a cross section exactly equal to its own, if broken can produce no injurious effect, as it must always remain in its place as if whole. The time required for removing the packings is very short, the cylinder lid being taken off and the cross head cottor knocked out; the piston is then drawn out, when the old packing is threaded off the piston, and a new one threaded on in ten minutes, and the piston replaced. From the long enduring elasticity of the coils, they are expected to last without examination at least 15,000 miles, the only need for examination being for the purpose of cleaning. There has not yet been time actually to wear out a ring, but as data upon which to form an approximate opinion, the ring marked No. 2, which is exhibited, has run more than 10,000 miles, and when taken out did not blow.

The new packing is also attended with economy in original cost, as the expense of piston and packing shows a considerable reduction on those generally in use.

Report on Experiments to determine the Relative Strength of Solid and Perforated Bricks.[*]

"Sir,—In accordance with your request we have instituted a series of experiments to determine the relative strengths of solid and perforated bricks. To do this, we have deemed it necessary to expose the bricks experimented upon to a transverse as well as a crushing strain. From the results which have been obtained from similar experiments made by Mr. Cubitt and Sir John McNeill, we have every reason to believe that in those trials the *machine*-made perforated brick was tested in comparison with the *hand*-made solid brick, which of course resulted in favor of the machine-made brick; hence the inference has erroneously been drawn that the perforated brick is stronger than the solid. If, however, the comparison is made between machine-made bricks only, it will be found that such is not the case, the solid brick being much stronger than the perforated, as our experiments incontestibly prove.

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[*] From Lond. Journ. of Arts and Sciences, No. 186.

" We have also made experiments with the London hand-made stock-brick, as well as the Staffordshire brick, also made by hand.

" The experiments were made with a 9-inch hydraulic press; the plunger by which the pressure was applied was one inch in diameter, and the weight was suspended to a lever, which multiplied the power 15 times. In applying the transverse strains, however, a shorter lever, which only multiplied the power by 5, was used. The bricks subjected to a crushing force were faced, so as to remove all inequalities; they were then bedded on a sheet of thin lead, and another sheet placed upon them.

" The pressure was communicated by a cast iron plate, so arranged as to adjust itself to the brick, and distribute the pressure uniformly over the whole surface. The weights were carefully applied, and allowed to come to a full bearing before more were added.

" In exposing the bricks to a transverse strain, the supports were placed two inches apart, and the weight gradually applied to the centre by means of a spring balance.

" The results of the experiments are shown in the annexed tables:—

Bricks exposed to Crushing Strain.

No. of Expt.	Description of Brick.	How made.	Weight of Bricks.	Tem. of Kiln.	Crushing Weight.			
			lbs.		tons.	cwt.	qr.	lbs.
1	Worcestershire, perforated,	Machine.	6	30 W.*	45	3	0	0
2	" solid, . .	Machine.	8¾	25 "	52	14	3	0
3	" " . .	Machine.	8¾	30 "	117	5	0	0
4	" perforated,	Machine.	6	30 "	47	17	1	11
5	London stock solid.	Hand.	5¾		13	3	0	0

Bricks exposed to Transverse Strain.

No. of Expt.	Description of Brick.	How made.	Weight of Bricks.	Tem. of Kiln.	Breaking Weight.			
			lbs.		tons.	cwt.	qr.	lbs.
6	Perforated Wors.	Machine.	6	30 W.	3	15	2	20
7	Solid "	Machine.	8¾	30 "	9	3	2	19
8	Perforated "	Machine.	6	30 "	3	5	2	5
9	" "	Machine.	6	30 "	2	3	3	15
10	Solid Staffordshire	Hand.	9½		2	4	0	19
11	" "	Hand.	9½		4	8	0	5
12	" Worcester,	Machine.	8¾	30 "	9	17	0	19

" In experiments Nos. 3 and 4, the cast iron plates through which the pressure was communicated broke with the final strain.

" The brick used in experiment No. 5 was not faced, and as it was 'dished' on the upper surface, the pressure was not uniformly distributed over the surface.

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* Wedgwood.

"The bricks termed Worcestershire are those supplied to us by you from the works of the Earl of Coventry.

"We have the honor to be, Sir.
"Your obedient servants,
"Horner and Molesworth,
"*Consulting Engineers.*

13, *Beaufort-buildings, Strand,*
June 10*th*, 1856.

"H. Chamberlain, Esq."

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*On the Employment of Sulphuret of Carbon for Industrial Purposes.**

By E. Deiss.

The author commences by stating, that in 1840 the price of sulphuret of carbon was as high as from 50 to 60 francs the kilogramme, but that soon afterwards he reduced its price so greatly that in 1848 he sold at 8 francs the kilogramme for the purpose of vulcanizing india-rubber. At present, with an apparatus composed of three retorts, he is able to manufacture the immense quantity of 500 kilogrammes of sulphuret of carbon in twenty-four hours; although scarcely a year ago, with the same furnace, the same retorts, and the same amount of fuel, he could only produce 150 kilogrms. in the same time. The product now costs him only 50 centimes the kilogramme, and he has no doubt that, by operating on a larger scale, it might soon be sold at 40 francs per 100 kilogrms. As, however, this substance has at present only a very limited employment in the vulcanization of india-rubber, the author having a large quantity on his hands, naturally desired to find some other purpose to which it might be applied; and considers that he has discovered one of the greatest importance, namely, the extraction of fatty matters.

He states that Paris daily produces 30,000 kilogrms. of bones, which are collected by the *chiffoniers*, and carried to the manufactories of ivory-black and gelatine. Here they are sorted, some being devoted to the production of ivory-black, others of gelatine, whilst some are sold to the workers in bone. The greater part of them (25,000 kilogrms. daily) are employed in the manufacture of ivory-black; but these undergo a preliminary treatment for the extraction of their fatty matter. The bones are broken and boiled with water for about three hours in large caldrons; the fat floats on the surface and is skimmed off; the bones are taken and thrown into a heap, to undergo a kind of fermentation, in which the production of heat induces a state of desiccation which fits the bones for calcination.

In these operations the bone undergoes a great alteration: the long boiling in water dissolves a great portion of the gelatine, which is necessary for the production of a good black; and the fermentation and long exposure to the air causes the almost total destruction of the animal matter, so that a bad black is produced for the sake of only 5 or 6 per cent. of fat.

The author states that much more advantageous results may be obtained by the employment of sulphuret of carbon. He proposes to crush the bones almost to powder; then to treat them with this agent, which almost instantly dissolves all the grease contained in them; and from this it may be separated by distillation, which is greatly facilitated by the low temperature at which this fluid boils, and the ease with which it may be condensed. The quantity of grease thus obtained is 10 or 12 per cent., and it is superior to that procured by boiling.

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* From the Lond. Chem. Gaz., No. 325.

He adds, that the same agent may be applied to the extraction of oils from oleaginous seeds and of the grease from wool. In the latter case the grease extracted becomes a useful product; it is a butyraceous substance, adapted for the manufacture of some kinds of soap.—*Comptes Rendus*, February 4, 1856, p. 207.

*On the Compounds of Carbon and Iron, and their Influence on the Production of Pig Iron.** By A. GURLT.

The compounds of iron with carbon, which are of such great importance in the commercial production of iron, inasmuch as, owing to the very difficult fusibility of pure iron, it would be impossible to obtain the metal without them on the large scale, belong to that class of chemical compounds in which several atoms of the electro-positive constituents are united to one atom of the electro-negative body; they may therefore be considered as subcarburets analogous to certain combinations of iron with sulphur. The tetracarburet, as it occurs most frequently in the white crystalline pig iron (*spiegeleisen*) or specular iron, and the varieties related to it, has long been familiar to us from the researches of Karsten. In it the iron is completely saturated with carbon, and cannot be made to take up more by prolonged fusion with charcoal. In its pure state it consists of 94·88 parts of iron, and 5·12 carbon, corresponding to the formula $Fe^4 C$. In this compound the whole of the carbon is chemically combined with the iron; it is rarely met with however in a state of absolute purity. In general it contains, in addition to iron and carbon, a variable amount of manganese, occasionally amounting to 6 per cent. As it is most frequently obtained from ores containing much manganese, on the other hand it usually contains a rather larger amount of carbon than the pure tetracarburet. As, however, the manganese replacing the iron in this compound possesses a lower atomic weight than the iron, a certain weight of manganese will combine with a larger amount of carbon than an equal weight of iron; and the amount of carbon which may exist in it without exceeding the maximum for the pure tetracarburet, will depend on the proportion of manganese existing in the specular cast iron.

The pure tetracarburet of iron possesses a specific gravity of 7·65 to 7·66, a silver white color, great hardness, is very brittle, and is commonly crystalline, although its form is of very difficult determination. According to Karsten and Hausmann, it does not belong to the cubic system, but the crystals consist of oblique prisms, among which an oblique terminal plane can occasionally be discovered, so that it would rather appear to belong to the oblique system. The crystals are most frequently tabular, and then appear to be merely rudimentary, intersect-

* From the Lond. Chem. Gaz., No. 327.

ing one another at indefinite angles. Mitscherlich observed an angle of 120°; Rammelsberg one of 116°, also of 130° to 131°; and the author found in a specimen from Silesia, angles belonging to oblique prisms measuring respectively 128° to 129° and 52° to 53°; still the primitive form cannot with certainty be determined from these measurements. The fracture is highly radiate crystalline, and frequently exhibits cavities between the crystalline laminæ. The specular iron is the most fusible of all the combinations of iron with carbon. Its melting-point is about 1600° C., and it becomes solid without previously assuming a thick pasty condition.

The octocarburet of iron, $Fe^8 C$, does not appear to have been recognised hitherto, although it not frequently occurs crystallized in gray pig iron, never, however, in white pig iron. It is distinguished from the tetracarburet not only by its chemical composition, but also very distinctly by its crystalline form and its other physical properties. The crystals which were observed by Karsten, but not further examined, belong to the regular or cubic system, and almost always appear in the form of confused octohedral groups, with the planes not well defined, but the angles occasionally sharp.

The author examined a piece of such crystallized cast iron from the works of Gleiwitz, in Upper Silesia, found in the core of a cast iron gun It presented the following composition:—

Carbon	2·46
Graphite	2·84
Silicium	0·26
Iron	94·20
Sulphur	traces
Phosphorus	
	99·76

The absolutely pure octocarburet of iron should contain by calculation 2·63 carbon, and 97·37 iron. In the above specimen, however, a small portion of the chemically-combined carbon was replaced, as has often been observed to be the case, by a small portion of silicium, while the graphite must be considered as mechanically mixed with the iron.

Hence the crystals examined may be considered as a mixture of a carburet of iron and siliciuret of iron, consisting of—

$$\begin{aligned} 91{\cdot}548 \text{ per cent. Fe} + 2{\cdot}46\ \text{C} &= 94{\cdot}008\ \text{Fe}^8\text{C} \\ 2{\cdot}660 \text{ per cent. Fe} + 0{\cdot}26\ \text{Si} &= 2.920\ \text{Fe}^8\text{Si} \\ \text{Graphite} &= 2{\cdot}840 \\ \hline & \quad 99{\cdot}768 \end{aligned}$$

In the former constituent the carbon is to the iron as 1 : 37·3, and in the latter the silicium is in the proportion of 1 : 10·0, closely agreeing with the calculated composition; and as the octocarburet so largely preponderates in this compound, one is fully justified in describing it as such.

The physical properties of the octocarburet are very different from those of the tetracarburet or specular iron; the specific gravity is = 7·15, the color iron gray, the hardness and brittleness much inferior; the former is to a certain degree malleable, as it retains the impression of the hammer when struck, while the latter flies to pieces; the fusibility of the octocarburet is less than that of the specular iron. It appears to occur frequently, its production being invariably connected with that of gray iron. The crystals are commonly found in the form of pyramids, extending to as much as two lines in thickness, often beautifully iridescent on the surfaces, in the cavities of large castings such as rolls and pieces of ordnance. These crystals, however, are not to be confounded with those regular crystals of soft malleable iron, which are sometimes produced during the oxidizing melting processes, such as refining and puddling; these latter contain no carbon, and are so free from foreign matters that they may be considered as nearly chemically pure iron.

The author believes that similar crystals to those of the octocarburet described above, have been found at the blast-furnaces at the Königshutte in Upper Silesia Ilsenberg in the Hartz, Marienhutte near Zwickau, &c., which have most probably a similar composition; but he has had no opportunity of investigating them more accurately.

As the existence of two distinct subcarburets of iron may be taken as a fact, it will become important to inquire what influence they exert on the production of pig iron. The several varieties of cast iron which are technically received at the iron works, may be brought into two groups, which differ from each other chiefly in their physical qualities. The first group will include all the varieties of white cast iron, which exhibit a silver-white color on the fracture, and a more or less radiate crystalline structure, together with a great degree of hardness and brittleness, and also a relatively high specific gravity = 7·2 to 7·6; and in them no graphite is ever to be distinguished by the naked eye. This group must, however, be subdivided into two subdivisions, determined by their chemical composition, the first of which will include all those varieties of white cast iron, containing a large amount of chemically-combined carbon, amounting to from 4 to 5 per cent., such as specular iron and varieties allied to it. The second subdivision includes all the descriptions of white cast iron containing smaller quantities of carbon, included in the technical term "white cast iron," but which generally contain considerable quantities of sulphur and phosphorus. In the second larger group are included all the varieties of gray cast iron in which graphite can be distinguished by the naked eye, possessing a specific gravity of 7 to 7·2, a granular structure, gray color, and greater toughness, but a less degree of hardness than the varieties of the first group. The gray cast iron must also be separated into two subdivisions, of which the mottled cast iron is the richer in carbon; the other is the gray pig iron proper, containing frequently a considerable amount of silicium. The essential constituents of all pig iron are but two, viz: iron and carbon, the latter in its modifications of graphite and chemically-combined carbon; all the other substances occurring in it may be considered as impurities. Among the electro-positive bodies, manganese is almost always present in cast iron, and at times zinc and copper, which replace an equivalent proportion of the iron; while the electro-negative substances, as sulphur, phosphorus, and silicium, replace the carbon combined with the iron. In proportion to the quantities in which these impurities are present, is their effect in modifying the physical qualities of the metal, such as its toughness and specific gravity.

Hitherto these impurities in the cast iron, which seldom amount to more than 4 per cent., have been neglected in considering its chemical constitution, although Karsten has directed attention to the influence which the electro-negative impurities exercise on the compounds of iron and carbon on fusion. As his experiments throw so much light on the formation of the carburets of iron, it may not be considered out of place here briefly to describe his results.

Karsten found that when cast iron containing the largest amount of chemically-combined carbon, $Fe^4 C$, was melted with sulphur in a covered clay crucible, there was found, on cooling, on the surface, sulphuret of iron, under this a layer of separated carbon in the form of graphite, and under this again a mass of cast iron with the maximum of carbon, proving in a most striking manner that the chemically-combined carbon is separated at the temperature of fusion in the form of graphite from its combination with the iron, and on the other hand that carbon was incapable of decomposing the sulphuret of iron. When this experiment was varied by pouring melted gray cast iron containing only 3·93 per cent. of carbon (of which 3·311 was graphite, and 0·625 chemically-combined) on to sulphur, whose quantity was not sufficient to convert all the iron into sulphuret, or when gray cast iron was melted with sulphur, there was found under the stratum of sulphuret of iron white cast iron with maximum of carbon, the whole of which was chemically-combined with the iron; and when the amount of sulphur was slightly increased, graphite was also separated. From which it is clearly proved, that the carbon in the melted cast iron, on the addition of sulphur, is continually concentrating in that part of the iron not combined with the sulphur until the point of saturation is reached, when graphite begins to be separated.

In the strict analogy to that of sulphur is the action of phosphorus, and also of silicium, which form phosphuret and siliciuret of iron, while the carbon is concentrated in the remaining iron, or the excess separates in the form of graphite. This behavior of the electro-negative constituents of the cast iron will explain the occasional occurrence of graphite in white cast iron, and even in well characterized specular iron; and this appearance is usually to be attributed to the presence of a little silicium, which combines with the iron at a very high temperature, and decomposes a portion of the carburet of iron. In fact, a small portion of silicium is always found in the analyses of white cast iron with graphite. The uncombined carbon, however, exists in such a small proportion in white cast iron as not to be seen by the eye, but is only discovered in its chemical analyses. From the action of sulphur, phosphorus, and silicium, on the carburets of iron above described, it follows that they must be considered as chemically-combined with the iron, replacing the carbon chemically-combined with it.

It is well know that the absolute quantities of carbon are different in white and gray pig iron, even when they are prepared from the same ores and under similar circumstances, the proportion of carbon being always less in the gray than in the white cast iron. The only exceptions to this rule are the varieties of iron produced by remelting in a reverberatory furnace, by which white cast iron can be converted into gray, and *vice versa.* In such irons the altered product usually contains the same amount of carbon as the material employed originally contained, one portion of the carbon merely passing from one modification to the other, viz: from the state of chemically-combined carbon to that of graphite when the product is gray, or from graphite to chemically-combined carbon when the product is white. In gray pig iron a large proportion of its carbon is not in a state of chemical combination, that is to say, it is in the form of graphite; with white cast iron this is very rarely the case, and those rare cases existing in very minute degree. It was mentioned above, that the conversion of the chemically-combined carbon into graphite was effected by the decomposition of the tetracarburet by sulphur, silicium, and phosphorus; there is, however, another method of separating the carbon from the tetracarburet in the form of graphite, that is, by heat.

It is known from experience that white pig iron may be converted into gray, causing a separation of carbon in the form of graphite, by exposing it to a degree of heat much above that required to effect its fusion; specular iron may even be converted into gray cast iron in this way; now this can only take place when its composition, as tetracarburet is destroyed, and it passes to some lower degree of carburation, setting free carbon as graphite. This high degree of temperature therefore effects this decomposition of the tetracarburet, and slow cooling favors the separation in large flakes; but even when this cooling is rapidly effected, the pig iron contains an equal quantity of graphite, which may be determined by chemical analysis, but which is difficult to be detected by the eye, from its being disseminated in minute particles throughout the mass, and for this reason a gray cast iron rapidly cooled appears to the eye like white cast iron. The degree of heat above that of its fusing point necessary to convert completely the specular iron into gray iron, has not been ascertained with accuracy, owing to the difficulty of measuring such high degrees of temperature; so much experience has taught, however, that in order to obtain gray pig iron, the temperature of the furnace must range far above the fusing point of specular iron.

As the absolute, as well as the relative quantity of carbon in the several varieties of cast iron is different, it may be asked whether it exists in any definite proportion to the iron not combined with any other electro-negative substance. With regard to white cast iron, the view is held that the combined carbon is united to the whole mass of the iron, though not in definite proportions. With regard to gray cast iron, however, it has been assumed that only a proportionally small quantity of the iron was chemically united to the carbon, forming a carburet, which was held in solution as it were in the remainder of the iron which existed in the state of malleable iron; still this soft iron was not to be considered altogether free from carbon, but to contain a minute quantity of carbon combined with it in the same manner as in bar iron. Against this view, which even yet has many supporters, it may be urged, that although it certainly is possible for carburetted iron to dissolve soft iron, as in the natural steel refinery and in the fabrication of cast steel; still the product is steel and not pig iron, and that its production depends upon processes essentially differing in principle from those upon which the production of pig iron depends. Steel is produced under all circumstances, directly or indirectly, by an oxidizing melting process, in which the separation of the sulphur, phosphorus, silicium, and also both the chemically-combined and free carbon, is so far affected by the oxygen of the air, that only a portion of the iron remains in the state of carburet, while the whole remaining mass is in the condition of soft iron. In the production of pig iron exactly the reverse occurs; the melting process is a reducing one, in which the iron is exposed to the action of a large excess of carbon and carburetted gases in the most intimate contact. If it be now considered that the affinity of iron for carbon at high temperatures is very powerful, as the process of cementation sufficiently proves, it must necessarily be admitted that if by any chance soft malleable iron should be present in gray pig iron, it must necessarily unite with carbon to pass again into a combination of iron and carbon, for it is impossible it could exist uncombined under the influence of the reducing gases of the furnace in the presence of the graphite, always intimately mixed with the gray iron.

While therefore we are forced to admit that the iron never exists in pig iron in the condition of malleable iron, but must always be, throughout its whole mass, in a state of combination with the electro-negative constituents, as carbon, sulphur, phosphorus, and silicium, the hypothesis of the existence of a polycarburet, which Karsten and Berthier assumed in order to account for the peculiar properties of crude iron, and which, according to Berthier, would contain 18·3 per cent. of carbon, must fall to the ground, because such a polycarburet could only exist simultaneously with soft iron. But independently of this reason, the hypothesis of a polycarburet is upset by the simple fact, that iron, by taking up rather less than 6 per cent. of carbon, is already saturated; and therefore its combination with 18 per cent. is an impossibility. We may therefore consider it as proved, that the chemically combined carbon is chemically united to the whole mass of the iron not already combined with the other electro-negative substances, and that the graphite is the only mechanical admixture in pig iron. If we are no longer permitted to doubt the existence in every description of pig iron of certain definite carburets, it becomes important to know the combining proportions of the carburets from which these different varieties of cast iron have originated.

In the specular iron, the pig iron containing the largest amount of carbon, these proportions are known: they are those of the tetracarburet, which contains one atom of carbon to four of iron. With regard to the gray cast iron, it is certainly remarkable that the crystalline octocarburet described above should occur so frequently and exclusively in it; and it becomes important to seek herein a close relation between the gray cast iron and the octocarburet. In fact, the following reasons appear to warrant the conclusion, that the carburet of iron existing in gray cast iron is the octocarburet:—1st, the physical properties, as color, hardness, toughness, specific gravity, malleability, agree in both; 2d, the octocarburet occurs very frequently in gray cast iron, and separates in the crystalline form from gray cast iron only; 3d, the tetracarburet (specular iron), at a temperature much above its melting point, becomes converted completely into gray cast iron, in which the proportion of chemically combined carbon represents that of the octocarburet.

If therefore we are authorized in considering the carburet of gray cast iron as identical with the octocarburet, and we bear in mind that gray cast iron is produced by the decomposition of $Fe^4 C$ at an elevated temperature, it becomes exceedingly probable that gray cast iron is always formed from the tetracarburet. If now the decomposition of the $Fe^4 C$ should not be complete, owing to the necessary temperature not being sufficiently protracted, it is clear that a cast iron will be produced composed of a mixture of tetra and octocarburet, such as the mottled cast iron. Mixtures of octo and tetracarburets of iron are found, however, in other cast irons differing much from the above, and which contain a large amount of white cast iron poor in carbon. This white pig iron, which often contains much sulphur and phosphorus, is always produced at a proportionately lower temperature and with an overcharged furnace. The small quantity of fuel consumed in the reduction of the iron produces this effect: the reduced iron does not remain long enough in contact with the fuel, and the supply of carbonizing gases being deficient, it does not become thoroughly saturated with carbon, and a portion of the iron remains as octocarburet, and is mixed with that portion which has been saturated with carbon to form the tetracarburet.

(To be Continued.)

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*Wetherhed's Method of Superheating Steam.**

The method invented and introduced by Mr. Wetherhed, late member of the United States Congress, for superheating steam, has been submitted to various trials during the last six months, in the dockyard at Woolwich, and has at length assumed a practical form. During the series of experiments to which the system has been subjected, various improvements were suggested from time to time, and it was, therefore, considered advisable to prolong the trials, and if possible to render the system complete. The method was first tried in the *Black Eagle*, Admiralty yacht, and was attended with a considerable saving of fuel; and before the late voyage of the *Dee* to the western coast of England, the machinery was fitted up with the appurtenances necessary for a further test of the system. The apparatus was at work on alternate days during the voyage, which was specially extended for the purpose, and the results obtained exceeded what was anticipated. The economy realized in fuel amounted to no less than 30 per cent. as compared with the ordinary system of using steam. The apparatus consists of iron pipes carried from the steam pipe along the front of the tube plate, and extending into the uptake or chimney, in which they are coiled to increase the surface. These pipes rejoin the steam pipe at or near the cylinders. Part of the steam passes through these pipes, and becomes considerably heated—superheated, as engineers say—and, combining with the ordinary steam before entering the cylinders, brings the mixed steam to about 340° Fahr. It is in this method of passing part of the steam used through coiled pipes in the uptake, and combining it with the common steam, before entering the cylinder, that Mr. Wetherhed's invention consists. The system of simply superheating without mixing the steam has been known for some time past, and has been attempted on many occasions, but without much success. In the first course of the experiments at Woolwich a difficulty existed, namely, the burning and consumption of the wadding. This difficulty has, however, been got over.

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* From the Lond. Mech. Mag., August, 1856.

Account of Experiments made in the year 1856 *on the Resistance Experienced by Screw Propellers when driven at high velocities, and immersed in the River Thames, at different depths.** By George Rennie, Esq., F. R. S.

[Read at the Meeting of the British Association, at Cheltenham, on the 8th Aug., 1856.]

It is now nearly a year since, that the author was invited, by Mr. John Apsey, a mechanical engineer, to witness some experiments which he proposed making on his premises, Broad wall (Christ Church), on the power of a double-threaded screw propeller, which he stated to have been invented and patented by him, but which had been previously invented and tried by another person.

The screw, which was fastened on a spindle, was mounted on an old wagon boiler, 6 ft. in length by 4 feet in width, and 4 ft. in depth, one end having a pulley fixed to it, and the other supported on a bracket or stand fixed to the bottom of the boiler. The spindle was allowed to work easily through a bush in the bracket, and also through a stuffing-box let into one end of the boiler, so that when the screw was made to revolve, by driving the pulley, it pressed against the water, and then against the arm of a bent lever, which raised a scale with weights, accordingly. First, the water was poured into the boiler up to the top part of the screw, and afterwards, at the different levels of *one, two, and three feet* successively.

The screw was driven by a steam engine, at 920 revolutions per minute.

The following were the particulars:—

Diameter of screw,	13⅜	ins.
Pitch of "	7	ins.
Length of "	15	ins.
End area of "	140	sq. ins.

	920 revolutions of screw, the weight lifted. lbs.	At one-half, or 460 revolutions, speed of screw. lbs.
When the water was level with the top of the screw,	67	63
When one foot above screw,	299	88
When two " "	350	112
When three " "	418	126

So that at one foot above the level of the screw the increase of pressure was	4·46 times.
at two feet above screw was	5·22 "
at three " "	6·86 "

While at 460 revolutions, or one-half the speed, the difference was only double, between the screw worked with the water on a level with the circumference of the screw, and when the water was 3 ft. above it.

Thus showing the great effect of working the screw at high velocities.

These results, when shown by the author to the Mechanical Section at Glasgow, in September, 1855, were questioned as to their accuracy, on the ground that, being made in a boiler, the water was necessarily confined within the narrow limits of the boiler, and the pressures indicated by the screw uncertain. To obviate these objections, a new apparatus was constructed in the month of March last, and fixed in the river Thames, opposite to a wharf in Holland Street, Blackfriars.

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* From the Lond. Artizan, Sept., 1856.

The screw propeller, having two blades similar to the common screw used in Government vessels, was fixed on the end of a horizontal spindle, and then driven by a strap connected with a steam engine at the rate of 558 revolutions per minute, and advantage being taken of the rise and fall of the tides outside the cistern. The screw was driven, when immersed, at different depths, and the following were the results of the different experiments:—

	Weight lifted.
When the water was level with the top of the screw, .	49 lbs.
" " 1 ft. " "	252 "
" " 2 ft. " "	343 "
" " 3 ft. " "	369 "
" " 4 ft. " "	—
" " 5 ft. " "	405 "
Here the differences between the first and second numbers are as	1·5
" between first and third, . . .	1·7
" " " " fourth, . . .	1 7·5
" " " " fifth, . . .	1·8·3

While the numbers are represented by a parabolic curve nearly, thus proving the effects of high speed, when the screw is unfettered by working in a boiler. The conclusions are, that speed is more favorable to developing the power of the screw propeller than depth, and this is more particularly shown by the slight differences of numbers when the screw was working at half speed in the boiler, as indicated also by the curve. If these experiments be borne out on a larger scale, the inference will be that small light propellers attached to the hollow, or after-run of the sterns of vessels, and worked at high velocities, will be preferable in many respects to large and heavy propellers worked at slow velocities in the dead wood.

For the Journal of the Franklin Institute.

Huge Forgings.

One of the cranks intended for Mr. E. K. Collins's new steamer *Adriatic*, was a short time since developed by Messrs. I. P. Morris & Co., from the mass of iron in which it was hidden, by the action of the powerful tools with which their shop is so well provided. The dimensions of the rough piece were 9 ft. 3 ins. long; 4 feet across at widest part; 2 ft. 5 ins. and 2 ft. 3 ins. deep at hub and eye, the middle or web part being depressed a few inches below those parts. Its weight in the rough was 31,544 lbs., which was reduced by finishing to 17,009 lbs.; a great part of the difference having been taken from the hub and eye, which were forged solid in two cylindrical pieces, by a cutter projecting from a boring head. At first sight it might be considered more economical to forge closer; but, the waste of material, consequent from the action of the fire during the long time required to bring such a large mass to a working heat; and, the almost impossibility of getting near enough to shape it while hot with hand tools, with its awkward form, disapproves that idea. Nearly all the larger forges are now supplied with powerful tools for shaping large unwieldy pieces when cold, consequently they are worked on while hot, only long enough to ensure perfect welding, and to obtain an approach to the desired shape; a closer approximation being made in the rough finishing done by the machines preparatory to the final completion by the more accurate tools of the machinist.

The large chips, too, are worked over again, so that comparatively nothing is lost. The shafts, which weigh 39 tons, cranks and other heavy forgings for the *Adriatic*, were made and furnished (except the one described,) by the Reading Forge Company, their establishment being well supplied with the necessary appliances for such work, having several of Kirk's patent hammers, large and small, a Nasmyth hammer of 5 tons, with large lathes and a shaping machine for rough finishing. The location of the forge is well chosen in the immediate neighborhood of the coal and iron districts, and having canal and railroad communication with the east and the west, it possesses facilities for supplying work cheaper than most other forges, and must become a successful competitor of the old establishments of Boston, New York, and Baltimore, for the heavy work of the machinists of those cities; the work just completed (for one of the largest marine engines built in the United States,) evincing its capacity for the heaviest work. The crank finished by I. P. Morris & Co., was sound and of most excellent material, and if that in the shafts be of the same tough and fibrous quality, the "*Adriatic*" will never be behind her time in consequence of her engines being disabled from that too frequent marine disaster, "a broken shaft." J.

Specification of a Patent granted to Richard Albert Tilghman, *of Philadelphia, U. S. A., for Improvements in the manufacture of Iron.**—[Dated 2d January, 1856.]

It has heretofore been proposed to mix common salt with the ordinary charge of iron furnaces, as it is put in at the top of the furnace; but salt being volatile at a red heat, is vaporized, in great part, by the current of heated gas, and is lost before it can act with full effect upon the materials in the furnace. Now, this invention consists in introducing common salt directly into the lower parts of iron furnaces where the temperature is very high, so that being there immediately vaporized and diffusing itself into the gaseous atmosphere, it penetrates into the pores and cavities of the materials, and in consequence of this great surface of contact, at an intensely high temperature, it produces a more powerful chemical effect.

The salt may be introduced either in the solid, melted, or gaseous form; but the method preferred is to feed dry powdered salt in a constant stream into the blast pipes of the furnace, so that the blast shall carry it at once into the hottest part of the furnace. The proportion of salt used is from about three per cent. and upwards of the weight of the iron and slag produced; but this may be varied according to the nature of the ore and fuel employed. As a general rule, the quantity of salt is increased in proportion to the excess of sulphur in the materials used.

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* From Newton's Lond. Journal, September, 1856.

The patentee claims "the introduction of common salt into the hot or lower parts of blast furnaces used in the manufacture of iron."

For the Journal of the Franklin Institute.

Description of Isaac Harman's Brick Machine. Patented August 12th, 1856.

By H. Howson, C. E.

This invention consists in the employment for making bricks of sliding moulds, constructed in two halves, each half having any convenient number of angular recesses and projections. A horizontal reciprocating movement is imparted by means of a crank motion to the moulds, which are arranged to slide in suitable guides. In addition to the reciprocating motion, the two halves of the moulds are caused by means fully described hereafter, during certain points in the movements of the machine, to separate from and come in contact with each other, the points of the angular projections of the two moulds always coinciding, so that the angular recesses of the halves together form oblong spaces of the form and size of the bricks to be manufactured. A knife is used in connexion with the moulds, and so operated by means of rods and levers fully described hereafter, that the moment the moulds are supplied with tempered clay all communication between them and the reservoir above is cut off. To the underside of one half of the moulds is hinged a radial plate, so arranged in connexion with levers and latches, as to open and close during the movements of the machine, when closed forming the bottom of the moulds, and when open allowing the bricks formed in the moulds to escape therefrom ; and to the upper side of one half of the moulds is hinged a radial lid, having a plate with projections corresponding in shape to the spaces formed by the angular recesses of the moulds. This lid is alternately raised and lowered during the movements of the machine, raised when clay has to be admitted, and lowered so that in conjunction with the above mentioned radial plate, the clay may be confined to the moulds at the time the two halves of the latter are brought together.

The whole is arranged and constructed for the purpose of manufacturing bricks of a superior quality and that at a rapid rate.

On referring to the annexed Plate, I.

Fig. 1 is a ground plan, showing Mr. Harman's improvements in machinery for making bricks.

Fig. 2, a sectional elevation on the line 1 (fig. 1.)

Fig. 3 and 4, elevations also in section of a portion of the machine with the moving parts in different positions.

Fig. 5 and 6, detached plan views, showing the moulds in different positions.

The same letters of reference allude to similar parts throughout the several views.

The frame-work of the machine is composed of the lower longitudinal beams A and A^1, connected together by the lower cross pieces B, B^1 and B^2; of the upright pieces C, C^1, C^2, and C^3, framed into the longitudinal beam A^1, the upper longitudinal pieces D and D′, secured to the top of the uprights, and upper cross pieces E, and intermediate piece F, which is framed into E, and which is supported at the opposite end on an upright piece resting on an intermediate piece G below, the latter being secured between the two cross pieces B, and B^1. To the top the longitudinal beam D, and that of the intermediate piece F, are secured the boxes *a*, *a*, and *a'*, *a'*, which serve as bearings for the journals of the shafts H and I. On one end the latter and outside the frames is secured a pulley or any other convenient driving apparatus, and on the opposite end is keyed a pinion J, gearing into a cog wheel K, on the end of the shaft H. On the face of the wheel K, and at a suitable distance from the centre, is attached a pin *b*, embraced by the end of the connecting rod L, the opposite forked end of which is jointed to lugs *c*, *c*, on the front half N, of the sliding moulds, the ends of the latter moving in guides M and M', secured to the opposite longitudinal pieces D and D', of the frame-work (see fig. 5). The holes in the lugs *c*, *c*, (through which pass the pins for connecting the forked ends of the rod L to the said lugs,) are oblong, so that the rod may have a slight longitudinal play, independent of the sliding moulds N and N', allowing the latter to have a temporary hesitation or dwell, at each extreme end of its movement, the object of which will be apparent hereafter. The half N of the sliding moulds is connected to the other half N', at each end by means of the bolts *d*, and *d'*, which are so arranged that during the movements of the machine, the projecting points of the two halves of the moulds, may at one time be in contact and at another time be removed from each other a limited distance, as seen in figs. 5 and 6. In order that these projecting points may always coincide laterally with each other and thus allow the intervening spaces to form accurate recesses for receiving the clay, the projection on one half of the moulds slide into corresponding recesses on the other half. On N' are lugs *f*, *f*, to which is jointed the radial lid P; this has a series of openings corresponding in shape and position to the openings formed by the sliding moulds when the two halves N and N' of the latter are in contact with each other. Into these openings fit accurately, but so as to move freely, the projections *h*, on the cover *i;* these projections also correspond in shape and position to the openings formed by the two halves of the sliding moulds, the distance of the outward movement of the projections *h*, is regulated by the heads of the pins *j*, *j*, which are permanently secured to the radial lid P, and which pass through holes in the cover *i;* to the latter is also secured a bent arm *k*, (see fig. 1, and in dotted lines figs. 3 and 4), this will be referred to hereafter.

Underneath the half N' of the sliding moulds are lugs, *m*, *m*, corresponding to the lugs *f*, *f*, above, and to these lugs *m*, *m*, is jointed a radial plate Q, having its upper surface flat, and so arranged that at certain periods during the movements of the machine it shall entirely cover the openings in the sliding moulds as seen in fig. 3; the points of the latches *s*, *s*, jointed to projections underneath the forked end of the connecting rod L, serving to maintain the radial plate in the latter position as long as may be required. To the plate Q, is secured a bent arm *q*, so arranged as to come in contact at the required time with the cross bar R, which connects the opposite guides M, and M', together. I is a shaft having its bearings in boxes *p*, *p*, secured to the opposite beams D, and D', of the frame-work, and to this shaft are secured the two bell crank levers T and

T′, the horizontal arms of which are furnished with counterbalance weights the vertical arms being jointed by means of the links *t*, *t*, to the cutter *v*, (fig. 5), which slides in guides *u*, *u*, attached to the main guides M, and M′, and which has angular projections, formed to coincide with the angular recesses in the half N′ of the sliding moulds. To the top of the vertical arm of the bell crank lever T, and to the same pin which connects the latter to one of the links *t*, is jointed the rod V, the opposite end of which rests on the top of the shaft H, and is so acted upon by a projection *v*, on the latter in conjunction with the weights, as to draw the cutter U, backwards and forwards at the required time. To the guides M, and M′, is secured the reservoir W, for receiving the clay to be formed into bricks. This reservoir is formed of two plates W, and W′, jointed together, and each plate has angular projections and recesses corresponding to those of the two halves N, and N′, of the sliding moulds.

The projections and recesses of the front plate *w*, coinciding with those of the front half N, of the sliding moulds, and the projections and recesses of the back plate *w*′, coinciding with those of the back half N′ of the same, when the latter is brought forward to the position shown in fig. 2, and when the two halves of the mould are separated to their utmost limit.

The bottom edge of the plate *w*, fits just so close to the top of the half N of the moulds, that the latter may move freely, but the bottom edge of the plate *w*′, is so far distant from the top of the front half N, of the sliding moulds, as to allow the knife U, to pass easily.

On the top of the guides M, and M′, are brackets X, having projecting pins on which run loose the rollers *x*, which when the sliding moulds are in the position shown in fig. 4, bear one on each side of the plate P.

Two drums Y, and Y′, run loose on brackets *y*, *y*, secured to the beams A, and A¹. Around these drums passes an endless band, and the whole is set in motion by a strap or cord passing round the shaft I, and around one end of the drum. The properly tempered clay being admitted to the reservoir W, the machine is set in motion by turning the shaft I in the direction of the arrow.

Supposing the moving parts of the machine to be in the position shown in figs. 1 and 2, that is, with the connecting rod L nearly at its outward stroke, and the two halves M and N′ of the sliding mould consequently drawn forward, and separated from each other to their utmost limits, so that their angular projections and recesses may coincide with those in the reservoir, at the same time the radial plate Q has, through the contact of its arm *q*, with the cross bar R, closed the underside of the sliding moulds and the lid P, with the plate I, and its projection *h* has been raised by the arm *k* coming in contact with the pin projecting from the bracket X, at the same time the projection V on the shaft H has caught the end of the rod V, and has withdrawn the knife V from the reservoir. The tempered clay now passes from the reservoir into the space between the two halves N and N′ of the sliding moulds.

On the further movement of the shaft H in the direction of the arrow, the rod V becomes released from the projection, and the counter balance weights will act on the levers T T′ and links *t*, *t*, so as to project the knife V forwards, until its angular projections coincide with the angular recesses in the half N′ of the sliding moulds, thus effectually separating the clay in the reservoir W from that in the said sliding moulds.

At the time of the releasing of the rod V, and consequent movement of the knife takes place, the connecting rod L has arrived at its utmost outward stroke, and on the further movement of the machine commences its reverse stroke. It does not immediately commence to move the sliding mould, however, on account of the oblong holes in the lugs *c*, *c*, already alluded to. When the pins, which serve to connect the forked ends of the rod L to these lugs, have arrived at the end of the oblong holes, the points of the laches *s*, *s*, have caught underneath the radial plate Q, rendering the latter a permanent base for the clay in the moulds to rest upon. (See fig. 3.)

The sliding moulds, with the clay contained therein, are now carried forwards, until the ends of the elevated radial lid P, come in contact with the rollers x, x, at the same time the bent lever K, being released from the pin on which one of these rollers is hung, the radial lid P now falls down, and the projections h h on the plate i, rest on the clay contained in the moulds, the projections coinciding on one side with the angular projections and recesses in the half N′ of the sliding moulds.

The whole sliding mould is then carried forward still further, until the half N′ strikes the points of the set screws 3, 3, in the bar R, when the further progress of this half of the mould is retarded, the connecting rod, however, has not yet reached its utmost stroke, and does not do so until the half N of the mould has been pushed so close up to the other half, that the angular projections of one touch coincide with the angular projections of the other, and the recesses of both combined form a series of oblong spaces or recesses of the same size as the bricks to be manufactured. (See fig. 6.)

It will be observed, that, as the clay which was first admitted to the moulds, when the latter was separated or expanded, is in the present position of the machine confined above by the radial plate P, and projections h, and below by the locked plate Q, so that the moving together or contracting of the two halves of the moulds must necessarily condense the clay, and cause it to assume compact masses of the desired form. The connecting rod has now reached its extreme movement and the bricks have been formed in the moulds; it now remains to release them from the same, and drop them on the endless band below. As the machine continues its movements, the connecting rod reverses in the first instance, the latches *s*, *s*, are withdrawn from under the plate Q, which drops down and assumes the position shown in fig. 4. As soon as the pins which connect the forked end of the rod to the lugs *c*, *c*, arrive at the end of the oblong openings, in the latter, then the half N, of the moulds is again removed a limited distance from the other half N′, releasing the bricks, which being now acted upon by the weight of the projections h, on the loose plate i, fall on the endless band and are carried to the distance required, (see fig. 4.) As the sliding moulds now move back towards the position shown in figs. 1 and 2, the ends of the radial lid P, becomes released from contact with the rollers x, x, and at the same time the bent arm k, striking the pin on which one of these rollers is hung, elevates the radial lid with its loose plate i, and projections

Fig. 2.

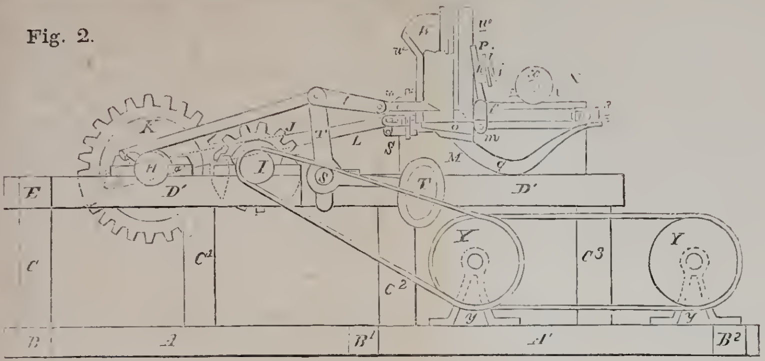


Fig. 4.

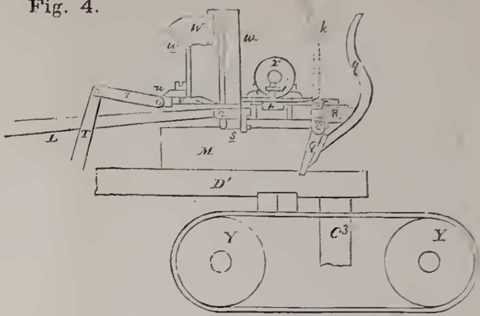
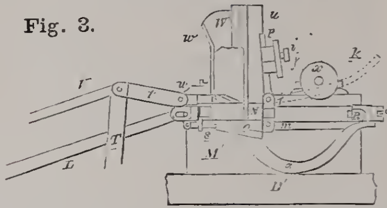


Fig. 3.



HARMAN'S PATENT BRICK MACHINE.

Fig. 1.

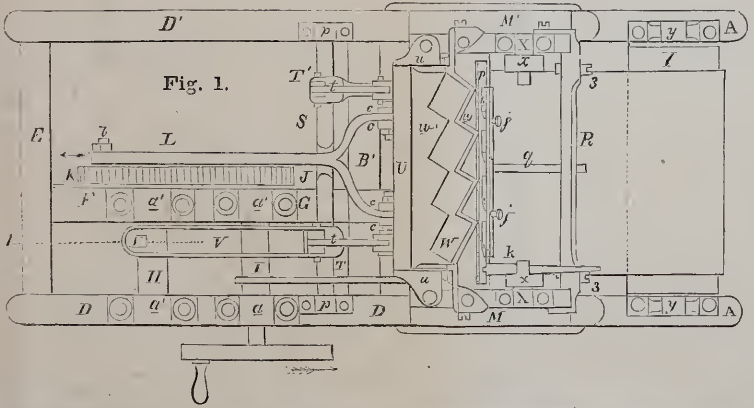


Fig. 6.

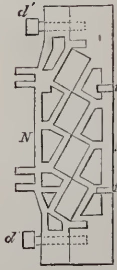
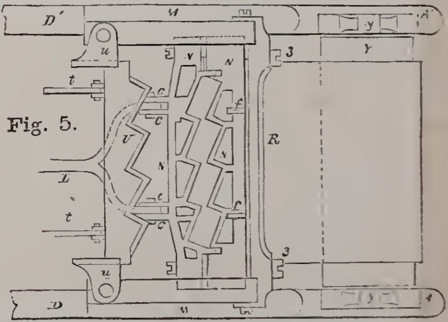


Fig. 5.



h, to the position shown in fig. 2, during the same movement, the bent arm q, has come in contact with the bar R, and again closed the plate Q, preparatory to being afterwards caught by the latches s, s. The projection v, on the shaft H, catches the end of the bent rod V, and withdraws the end of the knife U; and thus the moving parts of the machine assume the position shown in figs. 1 and 2, when a repetition of the above described movements takes place. It will be understood that the principal feature in this machine is the arrangement of the moulds, which expand when clay is first admitted, and afterwards contract so as to condense the clay confined in the moulds above and below, into a compact mass, making pressed bricks of a superior quality, and at a rate of speed hitherto unknown.

*Experiments on Iron made by Mr. Bessemer's Process.**

My Dear Sir,—It may interest you to hear of a few experiments made on the iron produced by Mr. Bessemer, made according to the process now so familiar to all. First, as to mechanical tests—

1. A mass of iron, about 15 inches long by 6½ square, made from Blaenavon pig, just as it came from the iron mould into which it had been poured, was heated in the scrap forge, and reduced to a conveniently sized "bloom" under a one-ton Nasmyth hammer. The appearance of the fracture of this mass, before heating, was similar to that usually described, viz: crystalline, porous, and of a brilliant lustre.

2. The bloom worked very stiff and rigid, and when sufficiently reduced was passed through the rollers, and made into a bar 2 inches wide by 5 thick. Cut with the shears when hot, a good incision was made to about one-third of the thickness, and the remainder fractured in the operation. Another portion of the same bloom was hammered into a short inch square bar under the same hammer, and when cut hot presented the same result.

3. When cold, the first-named bar, once hammered and once rolled, had a nick cut all round, and was broken short off on receiving a blow with a hammer. The fracture clean, laminated as if the crystals were squeezed by the pressure into horizontal layers; no fibre.

4. The two portions faggotted, heated, and hammered into a cylinder of 1 inch diameter; nicked all round, broken with a blow, a clean fracture, no fibre, the first crystalline appearance *restored*, as if the crystals had been simply pressed back by hammering in a direction contrary to the first.

5. The two portions faggotted, heated, and hammered to the same dimensions, a slight nick made on *one* side, fractured by a blow, with the same result. Impressions of the fractured ends were taken in lead, and when compared, at each fracture, had the same appearance, with no increase of fibre.

6. One portion of the last made bar accurately turned, and placed in the machine for testing the tensile strain. A portion of the fracture had an oxidized appearance, which portion was the first to give way, and

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*From the Lond. Journ. of the Society of Arts, No. 199.

without appreciable elongation. The iron worked harsh and rigid under the hammer, but well and pleasantly in the lathe. My experiments having been generally with cast iron, I regret not having many with wrought iron for comparison, but you will easily supply them.

The diameter of the specimens at the line of breakage = ·6-inch.

The breaking weights are the means of two specimens, except in that by Bessemer's process, one only being tested.

NATURE.		Breaking weight in lbs. per square inch.	Elongation before fracture.	Diminution of diameter before fracture.	REMARKS.
			Inch.	Inch.	
Wrought iron made from	Magnetic ore of Londonderry, Nova Scotia,	66,491	·109	·123	Fibrous fracture.
	Catalan bloom, hæmatite and specular ore of Londonderry, Nova Scotia,	59,594	·332	·199	Ditto.
	Magnetic ore of Nictau,	67,905	·232	·146	Ditto.
	Shell ore of Nictau,	61,039	·234	·204	Ditto.
Bessemer's process (heated and rolled once, heated and hammered four times,) preserving the *laminated* appearance to the last.		65,999	·113	·014	Crystalline partially oxidized.

Chemical Analysis.—A portion of the ingot, taken before making the bloom, selected with great care from a solid inner portion of the mass, so as to avoid cavities, fissures, or fused portions of oxide of iron, &c., was submitted to examination. No silicium whatever was detected. No trace of graphite, or of uncombined carbon. Combined carbon not exceeding 0·3 per cent. Phosphorus 0·44 per cent. Sulphur 0·056 per cent. A similar result was obtained some months ago from a sample produced by the same process by Mr. Bessemer, from another description of iron. Blaenavon iron is comparatively free from these last impurities. For comparison, a pig was taken at random from a heap of Blaenavon iron, which yielded to the same treatment the following comparable result: —Phosphorus, 0·48 ; sulphur, 0·062.

It appears, therefore, that while the uncombined carbon and silicium had been completely removed by the oxidizing process (their oxidization being probably almost concomitant), the complete removal of the combined carbon is a matter of greater difficulty, and that the phosphorus and sulphur are but little affected. It would appear that when disseminated in small quantities, in a combined state, through large masses of metal, they are difficult of oxidization, and require longer treatment. It is an interesting question as to how long this treatment may be continued before the mass becomes viscid. In the act of pouring it into the mould, considerable quantities rapidly take up their appearance on the sides of the funnel, as if the tendency of the process was to induce that state. I merely mention this for consideration, and not as supposing the matter is so near complete elucidation that anything definite can be pronounced.

It may be remarked generally, that the above results are only applicable to iron treated in *one* way, *i. e.*, to a *certain* iron which has remained a *certain* time under peculiar treatment. Experiments, accurately made, will show whether *time* is not an important element, that is, when the process must be stopped. As regards the iron made under the above conditions, the experiment is so far useful, if these are recorded. But nothing can be said about the system, as we may be entirely ignorant as yet of the true treatment required. On the other hand, the editor of the *Engineer*, Sept. 5th, states: "We may state that we have ourselves seen several specimens of the metal after being rolled, and which presented all the appearance of the best bar iron." Such a statement from such a quarter, whose duty it is to watch over and record these important matters, enables me gladly to draw the conclusion that there is a system by which the best bar iron can be made under this process, and perhaps he will shortly favor us with particulars. Very truly yours,

Royal Arsenal, Woolwich, Sept. 9, 1856. F. E. W.

P. Le Neve Foster, Esq., Secretary, Society of Arts.

P. S.—Since writing the above, I see in to-day's *Times* a letter from Mr. Bridges Adams, with these words:—"From that ingot has been forged at the Royal Arsenal, Woolwich, a 'bloom,' subsequently rolled into a *tough* bar 2 in. by ½-in., bearing all the mechanical indications of the *best charcoal iron.*" The italics are mine. This statement is so clear, that I can only suppose Mr. Adams must perhaps allude to some experiments in the Dock-yard (though I cannot hear of any), because no other than the above have been made in the Arsenal.

For the Journal of the Franklin Institute.

United States Steamer Wabash.

We have obtained from a reliable source, and publish below, the steam log of the United States Steamer *Wabash*, one of the five new frigates built under the recent Act of Congress, on a trial trip from New York to Portsmouth, N. H., on October 1st and 2d, 1856.

The *Wabash* was built at the Philadelphia Navy Yard. Her machinery by Merrick & Sons, of this City, has not been previously described in this *Journal*. It consists of four boilers of the kind known as "Martin's Vertical Tubular," duplicates of those made by the same firm for the U. S. Steamer *Susquehanna*, and described in our number for May last. Two horizontal steeple engines, on deep cast iron bed-plates; of which the cylinders have main balanced slide valves, and independent cut-off slide valve above it, adjustable while the engines are moving. Propeller is of brass, with gearing to hoist it, arranged like those of Penn, in England. The engine room is commodious, affording ample facility to get at all parts of the engines while in motion. At the forward end of the fire room (which is between the boilers,) is a donkey boiler fed by a small Worthington, and two large donkey steam pumps arranged as usual. The propeller shaft has a thrust bearing with several collars, as usual in English propellers, as also a Parry's conical bearing, on either of which the thrust may be taken at pleasure.

The bearings of the propeller are in wood.

The following are the principal dimensions of ship and machinery.

Hull.—

Length between perpendiculars,		262 feet 7 inches.
" over all,		301 " 6$\frac{5}{8}$ "
Knighthead to taffrail,		284 " 0$\frac{5}{8}$ "
Beam moulded,		50 " 2 "
" extreme,		51 " 4 "
Depth of hold,		26 " 2 "
Load draft,		23 "
Length occupied by machinery and coal,		60 "

Engines—Two—Horizontal steeple.

Diameter of cylinders,		6 "
Stroke " "		3 "
Revolutions per minute, maximum	50.	
Pressure of steam, "	18.	

Cut-off, variable 10 inches to 21 inches.

Boilers—Four—Vertical tubular.

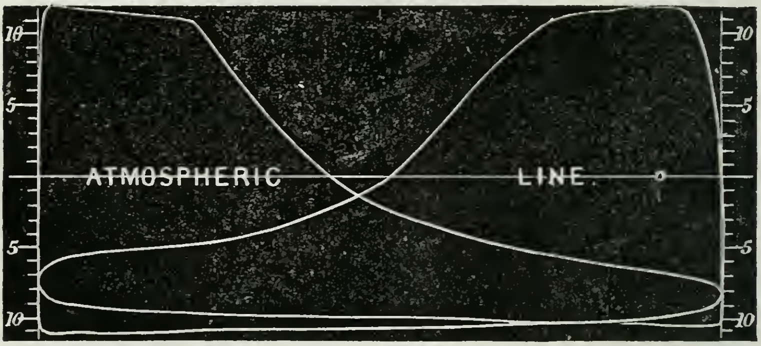
Horizontal area occupied by boilers and fire room,		32 ft. long by 31 ft. wide.
Height of ditto inclusive of steam drum,		15 feet 10 inches.
Top of steam drums above bottom of keel, or 3 inches below load draft of ship,		22 " 9 "
Number of furnaces in all boilers,	20.	
Total grate area,		338 square feet.
Heating surface in tubes,	8508.	
" " furnaces and flat surfaces,	3195.	
Total,	———	11,703 "

Propeller—Two bladed, true screw.

Diameter,	17 feet 4 inches.
Pitch,	23 "
Length,	3 " 6 "

For further particulars of boilers see Vol. XXXI, p. 357.

Indicator Card from the Wabash.



Forward Engine, Oct. 2d, 1856, 8·15 A. M.

Revolutions per minute,	45.
Pressure of steam,	15 lbs.
Vacuum,	27
Cut-off at,	10 ins.
Hot-well,	110°

The annexed log affords no indication of the speed which may be attained by steaming alone, as sail was set most of the time; but, it is chiefly valuable as showing the performance of the boilers. The engines worked smoothly, and an examination of the propeller bearings showed no wear.

Abstract of Log.

Hours.	Revolutions per minute.	Pressure of steam.	Vacuum.		Cut-off in inches.	Throttle (8 holes wide.)	Coal in pounds.	Saturation in boilers.			
			For'd.	Aft.				1	2	3	4
A.M.						holes.					
9*		15	28·5	28·5	12	3	2790	1¼	1⅛	1	1
10	46 1	15	28·0	“	12	5	3420	“	“	1¼	1¼
11	44 3	15	“	“	10	8	900	“	1	1¼	1¼
12	44 0	14	“	“	10	8	2250	1¾	1⅝	1½	1½
P.M											
1	40 8	16	27·5	27·5	10	8	5220	1⅝	1½	1½	1½
2	44·6	10	28·5	28·5	10	8	2520	1¾	1⅝	1⅝	“
3	44·4	14	“	“	10	8	2160	“	“	“	“
4	48·6	17	“	“	10	5	2250	“	“	“	“
5	46 6	17	28·	28·	10	2½	4770	“	1¾	1¾	1⅝
6	48·3	17	27·	27·	10	“	2970	“	“	“	“
7	48·0	16	“	“	10	“	2430	1⅝	“	“	“
8	44·4	10	“	“	10	3	3600	1¾	“	“	1¾
9	49·3	12	27·5	27 5	10	“	4500	“	“	“	“
10	49·4	10	“	“	10	8	3060	“	“	“	“
11	49·5	12	“	“	10	“	2880	“	“	“	“
12	48·9	12	“	“	10	“	3060	“	“	“	“
A.M.											
1	48·2	12	28·0	28·0	10	“	4770	“	1⅝	“	1⅝
2	46·0	12	27·5	“	10	“	3780	“	“	“	“
3	47·6	15	28·0	“	10	3½	4050	“	“	“	“
4	46·1	15	“	“	10	3	2790	“	“	“	“
5	44·3	12	“	“	10	8	1530	“	“	“	“
6	44·5	12	“	“	10	“	2790	1⅝	“	1⅝	“
7	43·9	12	“	“	10	“	3510	1¾	“	“	“
8	46·2	14	“	“	10	“	2610	“	“	“	“
9	49·5	14	“	“	10	“	3600	“	“	“	“
10†								“	“	“	“
11								“	“	“	“
12	44·7	10	“	“	21	3	1980	“	“	“	“
P.M.											
1	46·6	12	28·5	28·5	21	1½	2880	1⅝	“	“	“
2	44·3	12	29·0	29 0	21	“	2160	1½	1½	1½	1¼
3	44·8	12	28·0	28·0	21	“	2070	“	“	“	1½
4	46·2	14	27·0	27·0	21	“	2520	“	“	“	“
5	44·3	14	“	“	21	“	4230	1⅝	1⅝	1⅝	1⅝
6‡	46·0	14	27·5	27·5	21	“	2430	“	“	“	“
Av'e	45·8	13·1	27·8	17·8	12·5	5½	3018	1⅝	1⅝	1⅝	1⅝

* Passed the light ship off Sandy Hook at 8·30 A. M. † Not steaming.

‡ Passed Cape Ann Light at 6 P. M.

Distance run by chart, .	374	nautical miles.
Time of running, .	33½	hours.
Speed averaged, . .	11⅙	knots per hour sail & steam.
Under sail alone, .	13	“ were at times obtained.

For the Journal of the Franklin Institute.

Particulars of the Steamer " Hiawatha."

Hull built by Messrs. Cooper & Butler, Baltimore. Machinery by Messrs. Murray & Hazlehurst, Vulcan Iron Works, Baltimore. Intended service, between Baltimore and Richmond, Va.

HULL.—

Length on deck,	235 feet.
" between perpendiculars,	225 "
Breadth of beam,	35 "
Depth of hold,	13 "
Tonnage, Carpenter's measurement,	978 "

Frame of white oak and cedar. Truss braced fore and aft.

ENGINES.—One top beam engine.

Diameter of cylinder,		56 inches.
Stroke of pistons,	11 feet.	
Diameter of air pump,		44 "
Stroke " "		50 "
Diameter of steam valves,	15 "	14¼ "
" exhaust "	15½ "	14¾ "

Sickel's cut-off (improved).

RADIAL WATER WHEELS—(Iron).—

Diameter,	32 feet.	
Face,	9 "	
Number of arms,	26.	
One boiler,		
Width,	16 "	
Height,	14 "	6 inches.
Length,	14 "	

Three furnaces; two of them 60 inches, and one 50 inches wide, with two doors to each furnace.

Leading from the furnaces to the back connexion, there are—

4 flues,	21½	inches diameter,	66	inches long.	
2 "	19½	"	"	66	" "
8 "	8	"	"	24	" "

The gases returning to a 66-inch smoke pipe through 166 iron tubes, 4 inches in diameter, and 10 feet long. This plan of boiler was invented by James Murray, Esq., of the above firm, and possesses several new and valuable features in its design.

Each and every part of it is accessible for cleaning or repairs, and from the highly satisfactory results obtained from those now in use, may be classed with (if not superior to,) the best type of boilers now in use.

C.

Extract form the Report of Chas. W. Copeland and H. B. Renwick, Engineers, appointed to Examine " the Fragments of the Boilers of the Grand Trunk Ferry Boat which exploded on the 10th of June, 1856."

From the testimony before the Jury, it appears that the time from the arrival of the boat at the wharf at Longueuil, to the explosion, was from thirty-five to fifty minutes;—during this time the fires probably remained active, as the boat was soon to return to Montreal—further, the safety valve weights were at the end of the lever, and the two syphon gauges plugged up—so that only the Schaffer gauge remained to indicate the pressure, and this gauge, unlike the syphon gauges, would not attract attention by the escape of steam, or in any other manner, when the pressure had increased above the proper point. It is also testified that there were no cords or chains attached to the safety valves by means of which they could be lifted and sustained to allow of the escape of steam, and further, that these valves were blowing off freely at the moment before the explosion.

Under this state of facts the pressure within the boilers must have been sufficient to lift the valves and have exceeded forty-five pounds to the square inch. The evidence of the Captain is, that the escape of steam heard by others was through slip points separated partially by great pressure. Both accounts are probably true, and either of them indicates an excessive amount of steam.

First, We are therefore of opinion that by a gradual increase of steam while lying at the wharf, the pressure had become more than the safety valves could retain, namely, forty-five pounds to the square inch, on both boilers, and that this pressure had been allowed to accumulate by either the carelessness, ignorance, or recklessness of the engineers, and was too great a pressure to be carried with safety.

Second, Not only had the pressure within the boilers been thus permitted to exceed the limit of safety, but at the same time the water within the larboard and possibly in both boilers, had been allowed to fall below the tops of the flues either by ignorance or inattention, and their upper surfaces had become hot, so that upon starting the engine as testified to by some of the witnesses, the pressure upon the surface of the water was relieved, and the water rising or priming over the heated surface, increased the already unsafe pressure within the boiler nearly instantaneously to a degree beyond the power of resistance of any boiler.

The probability of low water, in the boilers, is further increased when the length of time that the boat had been lying at the wharf with active fires is taken into consideration.

Third, That by the explosion and separation of the larboard boiler, the starboard one received a severe blow or concussion, starting it out of its place, disturbing its water level, and causing a rupture and giving vent to the imprisoned steam, already at the unsafe pressure before mentioned.

Although there is no evidence to that effect, still it is proper that we should mention, that owing to the limited steam room in these boilers, it is quite probable that they primed or foamed very much, and that the engineers may thus have been deceived when the boat was under weigh as to the true height of the water, which by reason of this foaming appears sufficiently high when the boat is under weigh, but settles to a quiescent state at the moment the engines are stopped, and thus exposing a portion of the flues above the surface.

There is conclusive evidence both from testimony and observation that the water had been many times too low in both boilers, and it is at least more charitable to suppose that the engineers might have been ignorantly deceived in this manner, than to believe that want of water had so frequently occurred during the short time that the boat had been running, through their carelessness or recklessness; unless entirely too ignorant to be trusted at all with the management of the boilers, they must have been aware that the want of water is the most frequent cause of explosion, and that in such event they would most certainly be among the first sufferers.

On all steam vessels the engineers should be held responsible for the proper care and management of their boilers and machinery; they cannot be thus held responsible, nor can proper discipline be maintained, unless all the employees in that department are solely subject to the direction of the engineers in the performance of their duties. The unwarrantable conduct of Payette in directing and controlling the firemen in the performance of their duties, and ordering them to disregard and pay no attention to the directions of the engineers; giving orders entirely independent of, and unknown to them, and even to disobey them, was undoubtedly a fruitful source of trouble and danger. The control of the firemen being thus taken from the engineers, they could place no reliance upon them, or the performance of duties assigned to them, and they were subject to be deceived, and misled by their neglect of duty.

Such an entire want of subordination, system, and discipline in the management of a steam vessel, has never before come to our knowledge, and for this state of things we conceive that Payette is in a high degree censurable, and his conduct furnishes the only extenuation for the mismanagement of the engineers.

That the whole management of the engineer department of this vessel has been of the most dangerous and reckless character, we think does not admit of a doubt. The plugging up of the steam gauges and continuing to run with them in that state, the entire ignorance of the pressure to which the boilers were exposed—the constant occurrence of scant water in the boilers, and what is still worse, the pumping of water into them while in their heated condition, instead of hauling or wetting down the fires, and the prolonged absence of one or both engineers while the boat was lying at the wharf, with active fires burning and steam up, betray a degree of ignorance or recklessness or both—deserving the severest condemnation.

For the Journal of the Franklin Institute.

Notes on the Late Explosion of a Locomotive on the Baltimore and Susquehanna Railroad.

At the usual hour the fires were started by the night watchman on duty, the engineer having left every thing in readiness the evening previous. Shortly after the fires had been lighted the engineer and fireman arrived, and when a sufficient amount of steam had been raised, the engine was run out upon the track preparatory to an early start with a freight train, and while thus standing (at 3 A. M., Oct. 7,) the explosion took place, by which the fireman was killed, having been thrown some forty yards from where the engine was standing; the engineer escaping with some slight bruises. From the crushed appearance of certain parts of the forward end of the engine, it must have been thrown nearly perpendicular and then fell across the track. The hindmost driving wheels were thrown completely out of their pedestals and were lying alongside of the engine. The furnace *was spread* apart 12 *inches equidistant from the centre*, breaking the flanches connecting the tube sheet and crown of the furnaces to the sides, and in other respects injuring the engine; it was one of Winan's build, and had been running over four years, rendering the Company valuable service. The sides of the furnace were constructed half of copper and half of iron, the lower part copper, the upper iron. The copper lapping on the iron and stayed throughout with $\frac{3}{4}$-iron screw stay bolts, 4 inches apart. The fractures took place in the lap of the copper sheet through the rivet holes, running along the lap nearly in a straight line for 30 inches, and then taking a downward course for a distance of 15 ins. at one end, and 12 inches at the other, turned down against the lower portion of the sheet as shown in Fig. 1.

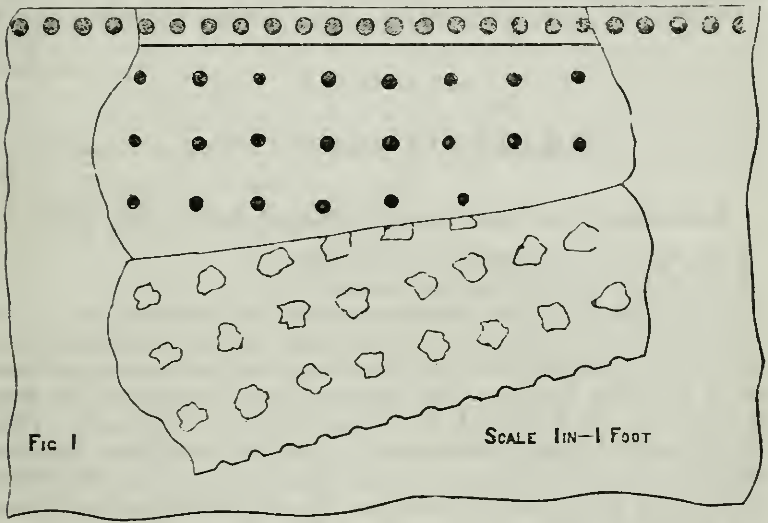
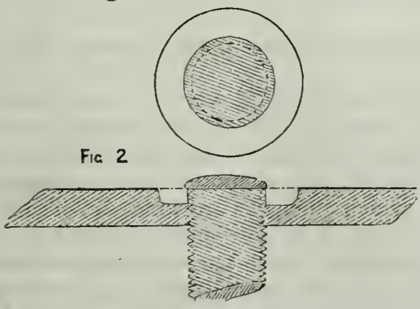


Fig 1

The original thickness of the copper appears to have been $\frac{3}{8}$-ths of an inch, but was much worn and reduced in thickness, the fractured section presenting the appearance of a wedge with one side corrugated, quite thin at the lap, and retaining nearly its original thickness at the lower edge of the furnace. The fire surface of the damaged portion of the sheet could not be examined, having lapped over so as to prevent it, but the opposite (copper) side of the furnace presented the appearance of having been cut out irregularly

Fig 2


Half size.

with a gauge varying in depth from $\frac{1}{16}$th to $\frac{3}{16}$ths of an inch, no portion of the fire surface near the centre of the furnace being exempt from this effect of intensified heat. The stay bolts were perfect, not the slightest effect visible from galvanic action; rather having the appearance of being recently been put in.

A phenomena presents itself in the effect the fire has had on the copper around the stay bolts, for which a satisfactory explanation is wanting, viz: *around each stay bolt, a circular recess is cut in, from $\frac{1}{8}$th to $\frac{3}{16}$ths of an inch deep, and 1½ inches in diameter, (or just twice the diameter of the bolts,) concentric with the bolts, having the appearance of being bored in with a centre drill, so near were they of a size in their diameters*, and cut close to the bolts, leaving nothing but the copper thread in the spiral groove of the stay bolt. Sketch No. 2 will give a general idea of this cutting process about the stay bolts.

The working pressure was 90 lbs., under ordinary circumstances.

C.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, October 16th, 1856.

John Agnew, Vice President, in the chair.

Isaac B. Garrigues, Recording Secretary.

The minutes of the last meeting were read and approved.

Donations to the Library were presented from the Commissioners of Patents; The Statistical Society; The Geological Society, and the Institute of Actuaries, London; The Regents of the University of the State of New York, and William J. McAlpine, Civ. Eng., Albany, New York; The Mercantile Library Association of the City of New York; The Massachusetts Charitable Mechanics' Association, Boston, Mass.; W. Milnor Roberts, Civ. Eng., Pittsburgh, Penna; Mrs. W. H. Keating and Messrs. J. H. Byram and Robert C. Cornelius of Philadelphia.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of September.

The Board of Managers and Standing Committees reported their minutes.

Candidates for membership in the Institute (22) were proposed, and the candidates proposed at the last meeting (17) were duly elected.

W. Jones exhibited a new style of set wrench whose general appearance is that of the ordinary **S** wrench, but composed of two distinct pieces or plates, upon the ends of which the jaws are formed. These plates lie together flat ways, and are held in position by feathers and grooves made in the thick parts that project above the plates to give the required depth to the jaws. Each half of the wrench has a feather and groove. Midway of the handle is a screw, secured in one plate from end motion by collars, and working in a nut attached to the reverse plate;

the axis of this screw is in the same plane as the junction of the plates, and at right angles to the interior sides of the jaws, and consequently, from the shape of the wrench standing at an angle with the handle. This position of screw causes the strains to approach those of tension and compression on the plates composing the handle, and correspondently lessens that of flexure. The appearance of the wrench is neat, and it looks more substantial than the ordinary screw or monkey wrench.

Also, an apparatus designed for crimping boot leather, consisting of a foot and leg piece hinged together near the instep, and provided with clamp screws for holding the leather on, and with a screw arranged to stretch it across the instep, by moving the hinged frame to which the clamp screws that hold the shank corners are attached ; another screw causes the foot and leg piece to assume an angular position with each other, the operator rubbing down with his hand any creases that appear, and regulating the clamp screw frame to equalize the stretching of the leather over the toe, the instep, or the leg part. The instrument is composed entirely of metal, and is mounted on a swivelling stand that can be moved so as to present both sides to the operator. It is not necessary that the leather should dry while on the machine, but it can be taken off and hung up by means of a looped string to dry, thus leaving the machine free to be used for fresh pieces.

Several apple parers were shown, which after paring, cut the apple into pieces or slices, ready for immediate use or for drying.

Henry Howson exhibited David E. Paynter's mode of solidifying coal dust by mixing it with plaster of Paris so as to render it portable and serviceable as an article of fuel, the ashes of which may be used as manure. (Two specimens, one of the solidified coal dust, and the other of the ashes, was shown,) for which a caveat has been entered at the Patent Office.

Also a model (to a scale of 1½ inch to a foot,) of the shrouds and buckets of a water wheel designed by H. Howson and A. Monnier, for Mr. Penrose's paper mills at Carlisle, Penna. The wheel is 30 feet diameter and 8 feet broad, and is constructed entirely of wood, with the exception of a few stay bolts. The peculiarity of the wheel consists in the arrangement of the back of the buckets, so that a free ventilation is afforded and sole plate dispensed with; the arrangement is in some respects similar in principle to that of Fairburn's iron wheel.

An illustrated description of the above in detail will shortly appear in the *Journal* of the Institute.

Also, new tail piece for violins by C. M. Zimmerman (patent applied for). This invention consists in a ready mode of removing and replacing the tail piece, also in a plan of connecting the strings to the same, without tying them in knots, but simply by means of a single fold in connexion with a peculiarly shaped peg. In the tail piece is a circular recess in which the ends of the strings are coiled.

Also, an improvement in flutes by J. Pfaff, which consists in placing the mouth piece of the flute at right angles to the body of the same, so that the instrument may be played upon without the performer twisting his arms and neck into an unnatural position.

S. S. Garrigues exhibited and explained the use of *Mitscherlich's Ap-*

paratus for estimating the real value of sugars, &c., and the determinations of saccharine liquids by polarization.

This apparatus is constructed on the principle of using the extraordinary ray of light produced by the Iceland spar, which if passed through the solution of the sugar, produces a play of colors, viz: yellow, green, blue, violet, and red. The dividing line between the red and violet being the point at which the calculations are made. The arrangements of this apparatus are of a more simple character than of those formerly constructed on the principle of polarizations.

S. S. Garrigues also exhibited specimens of bat-wing, fish-tail and Argand burners made of porcelain, the object being to get rid of the rusting, which occurs in metallic burners when exposed, thus preventing a perfect combustion of the gas.

THE COMMITTEE ON SCIENCE AND THE ARTS,

Model of an Apparatus for Extinguishing Fires.

The Committee on Science and the Arts, constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination, "the Model of an Apparatus for Extinguishing Fires," invented by Aaron Roberts, of Philadelphia, Pennsylvania:

Report—That they have examined an apparatus invented by Aaron Roberts, which is for the purpose of bringing the jet of water from a fire engine in closer contact with the fire than is usually accomplished by the ordinary means. This apparatus consists of a telescopic pipe, made in three or four sections, or as many as will be found convenient for the height it has to be raised; each joint or section of the pipe is raised by a pinion working into a rack that is secured to each section, and may be raised to any required height within the entire range of the pipe; the upper section terminates in a small pipe, (on an universal joint) of suitable size for the jet intended to be thrown on the fire; the pipe is directed by means of cords or male chains extending to the ground, whereby the water is directed to the fire. There are also ropes or chains attached to each section of the pipe, for the purpose of keeping it steady when elevated. The pipe is secured to a platform of sufficient size, (placed on wheels to facilitate its movement,) and large enough to support the pipe when elevated to bring it into use. There are screws placed on the lower section of the pipe, for attaching the hose from the engine or engines that connect with the pipe. The whole arrangement displays ingenuity, and would answer a good purpose when placed in a proper situation and well directed, and would have the advantage of bringing the jet of water in closer contact with the fire; it would also supersede the necessity of carrying the hose up on a ladder. It might be taken to a fire on a carriage or truck, similar to our hook and ladder trucks, and thus rendered a useful appendage to our fire department.

By order of the Committee,

William Hamilton, *Actuary.*

Philadelphia, August 14th, 1856.

JOURNAL

OF

THE FRANKLIN INSTITUTE

OF THE STATE OF PENNSYLVANIA

FOR THE

PROMOTION OF THE MECHANIC ARTS.

DECEMBER, 1856.

CIVIL ENGINEERING.

Description of the Drainage of the Haarlem Mere.[*]

(Continued from page 297.)

The width of the canal is not every where the same; from the *Schinkel-polder* on the south-east side of the lake to the sluices at *Halfweg* it has the greatest breadth, amounting to 45 met. (147½ ft.), for a good conveyance of the water to the sluices. From *Halfweg* to the *Oude Wetering* on the south side its breadth is 40 met. (131¼ft.), the remaining part being 38 met. (124½ ft.) in width. At the foot of the enclosure of the bank, at the side of the canal, an enlargement has been made along its whole length, having a breadth of 6 met. (19½ ft.), for a towing-path, which, between the sluices *Halfweg* and the *Spaarne*, has been brought to 11 met. (36 ft.), a provision for the future enlargement of this part of the canal also, if necessary, to a width of 45 met. A second foot-path, having a breadth of 2 metres (6 ft. 2 in.), has been constructed for giving a greater capacity to the canal when (as in the winter) the waters rise to a high level, offering, at the same time, a ready means of increasing its capacity if hereafter found necessary. The top of the embankment has a height of 1·307 met. (4 ft. 3 in.) above the datum line, which we will notice hereafter. The breadth at bottom is generally 11 met. (36 ft.), at some points more, while its breadth at top, on the whole length, is 4 met. (13 ft.) Its slope on the side of the mere is five times the height: on the side of the canal, twice the height. A section of the canal and embankment is given (see Fig. 2), showing its configuration where it intersects the low lands of the *Schinkel-polder*, thus necessitating a second embankment on the other side of the canal to isolate it therefrom. At the time of the construction of the embankment, its height was considerably more than the intended one described above, this greater height being an allowance for the contracting of the materials of which

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[*] From the Lond. Artizan, July, 1856.

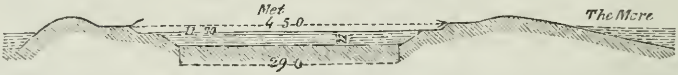

Fig. 2.

its body was formed, a great deal of which was peat, a material, however, which, after being thoroughly dried, is very compact and impervious. At some points many and great difficulties had to be surmounted while constructing the embankment, arising from the softness of the soil, which was accomplished by the use of fascines and layers of sand, but which raised the cost of this part to 52·58 fl. per running met. (=£4 per yard), this being the highest price which was paid for the canal and embankment. Where they were not constructed through the water, the price varied from 21 to 32 fl. per met. (from £1 12s. to £2 8s. 8d. per yard). The construction of the embankment through the water was performed by the lowering of layers formed by fascines, until a good basis had been formed, on which was laid the body of the embankment. On the other side, a second dam had to be constructed, after which the water was removed from the enclosed space, for the formation of the canal; the cost of these works being on an average 126 fl. per met. (£9 12s. per yard). Great difficulties arose at the construction of the canal and embankment on the south-east side, where the existing meres and pools had to be isolated from the lake. The small strip separating these waters, which seemed to be land, was not really so, but consisted of water-plants, so tightly interwoven, that they formed a layer, floating on the water, and of such a stability that a man could walk on it with perfect security. This phenomenon is met with at different places where a fenny bottom is covered by stagnant water, which greatly promotes the growth of aquatic plants, which originate at the bottom and afterwards float to the surface, where they collect and form the floating land as described. It was not an easy task to construct an embankment on such a foundation, but it was happily accomplished in the following manner:—At the place where the canal had to be made, the floating land was cut away, and the stuff thus got out was thrown up at the sides upon the line where the embankment had to be formed; thus, by continuously bringing upon it new layers, the floating land under the now partly-formed bank was sunk by the superincumbent weight, which was augmented by the materials resulting from the dredging of the bottom of the canal, until the first layer reached the bottom, at the depth of no less than about 3·5 met. ($11\frac{1}{2}$ ft.) beneath the surface. On this basis the body of the embankment was constructed, which has proved to be very compact and firm. The canal has a length of 59·596 kilom. (37 miles), and has cost, with the embankment, 1,938,328 fl. (£161,528), or 32·52 fl. per met. (£2 9s. 6d. per yard). The embankment, though at first not quite impermeable, which is seldom the case with such works, when newly laid, showed no alarming symptoms of leakage, and has since stood very well. At some points new materials had to be brought upon it, to compensate for the lowering and contracting of the top, by the drying up of the materials of which it was formed, and many repairs had to be undertaken, in consequence of damages by storms before the finishing of the drainage. In 1843, the enclosure of the mere was finished, save the points which had to be held open for the navigation, and which were not to be closed before the commencement of the drainage, which was considerably delayed by many circumstances, the description of which, however, has little interest for the reader.

In the meanwhile it was taken into consideration what was the kind of engine and machinery for raising the water to be adapted, it having previously been determined that steam was preferable to the inconstant and variable force of the wind. The determining of this point was confided to the engineer, Byerinck, and the professors Simons and Lipkens, of which the last named is since deceased. The conclusions of their report were chiefly as stated hereafter.

The first point to be kept in view was that whatever description of engines were employed, they were not only to be so constructed as to be suitable to empty the waters from the mere, but that afterwards they also might keep it dry. Once being dry, the same engines which had served to empty the lake, and therefore had been continuously at work, had but to be set in action at intervals for the discharging of the superfluous water resulting by rains and filtration, so that the force required for this purpose being known, the engines could be projected according to this basis, while they should be powerful enough to drain the lake by a continuous action. The quantity of water to be carried off amounted to 724,000,000 cubic met. (about the same number of tons), to which were to be added 36,000,000 cubic met. yearly during the drainage, and 54,000,000 afterwards. But to ensure a good drainage afterwards, the most unfavorable circumstances had to be taken into consideration, that is, very wet months; the greatest quantity of water to be raised during one month amounted to 36,200,000 cubic met., which calculations were based on the results of observations continued during 91 years.

According to experiments, the largest wind-mills used raise in no case more water than 60 cubic met. to the height of 1 met. per minute. Experience has shown that such mills work with full force during no more than sixty days of twenty-four hours out of the 365 days of the year, so that such a mill can raise yearly about 5,184,000 cubic met. of water, or say, 6,000,000 to the height of 1 met., or 19,374,000 tons of water to the height of a foot. It is assumed in practice, that such a mill (the number being in due proportion to the surface of the land to be kept dry) must work thirty days yearly for thoroughly draining such low lands, so that the duty of such a mill may be reckoned at 3,000,000 cubic met. of water raised 1 met. yearly. These calculations are, perhaps, too much in favor of the wind-mills, it being the reporter's wish not to exaggerate the advantages of the use of steam power.

The height to which the water was to be raised after the drainage of the lake, was 5 met. (16 ft. 5 in.), so that two rows of mills were required, the highest of which was to receive the water raised by the lower ones, and in each row were required 60 mills; or while there existed examples of land kept dry by a slightly less number, 57 mills were assumed for each row, or a total of 114.

A horse-power being equal to 75 kilos. raised one met. per second,* or 4·5 cubic met. water raised to the same height per minute, the useful effect of a horse-power actuating a pump may be fairly taken at 4 cubic met. raised 1 met. per minute, while if actuating scoop-wheels, or archimedean screws, it will amount to 3·5 cubic met. Deducting a day monthly for stopping, the steam engines, capable of discharging the quantity of water monthly under the most unfavorable circumstances when moving pumps, should be of 1084 H. P., while with the use of scoop-wheels or screws, 1238 H. P. would be required, or, in round numbers, say 1200.

It was, therefore, recommended to have single-acting engines, working pumps divided at three points of the lake; each engine of 360 H. P., or when it should be found necessary to use less powerful engines, six engines of 180 H. P. each, which could be worked at 200 H. P.

If the use of wheels or screws should be preferred, two rows of engines were to be erected, each row having three engines of at least 200 H. P., so that a total of six engines would have to be constructed, of a collective power of 1200 horses—these engines, however, to be double-acting.

Using wind-mills, the highest row, of fifty-seven mills, should be capable of emptying the half quantity in 14·2 months, or say fifteen months, after which time the lowest row could be erected. The second half having to be raised so much higher, could not be discharged in less than at least double the time—say thirty-three months—so that, if all the circumstances were highly favorable, the mere could be drained within a space of four years. The price of each wind-mill was reckoned at 26,000 fl. (£2166), and the expense for attendance and repairs, 750 fl. (£62 10s.), so that the total expense for the 114 mills, during four years, including the interest on capital, would amount to rather more than 3,700,000 fl. (£30,000).

If single-acting steam engines and pumps were to be used, taking but 250 working days annually, no less than 115 days being allowed for stopping, for repairs, and other causes, they could drain the mere in ten months and a half—say fourteen months—as a pump, in common with all water-raising machines, does not produce the same useful effect at the different heights to which the water is raised. It was calculated that the drainage in this manner would necessitate an outlay of 1,200,000 fl. (£100,000).

In the case of steam engines actuating scoops or screws, the upper half of the water could be discharged by three engines, of a collective power of 600 horses in 6·1—say 8 months—when the other three engines had to be erected, and the remaining half—for the same cause as in the case of wind-mills—would require 12·7—say 16 months—so that the drainage in this case would be accomplished within two years, at an expense of 1,700,000 fl. (£142,000).

The yearly expenses for keeping the lands dry after the drainage, would

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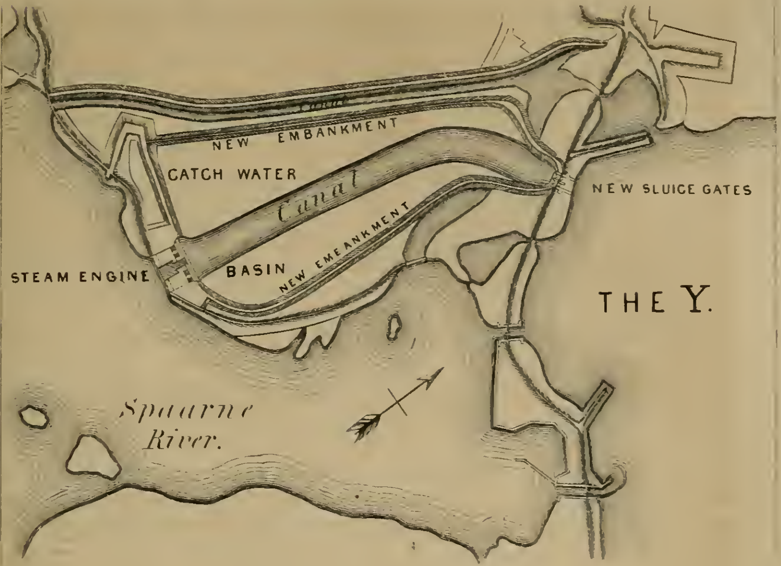
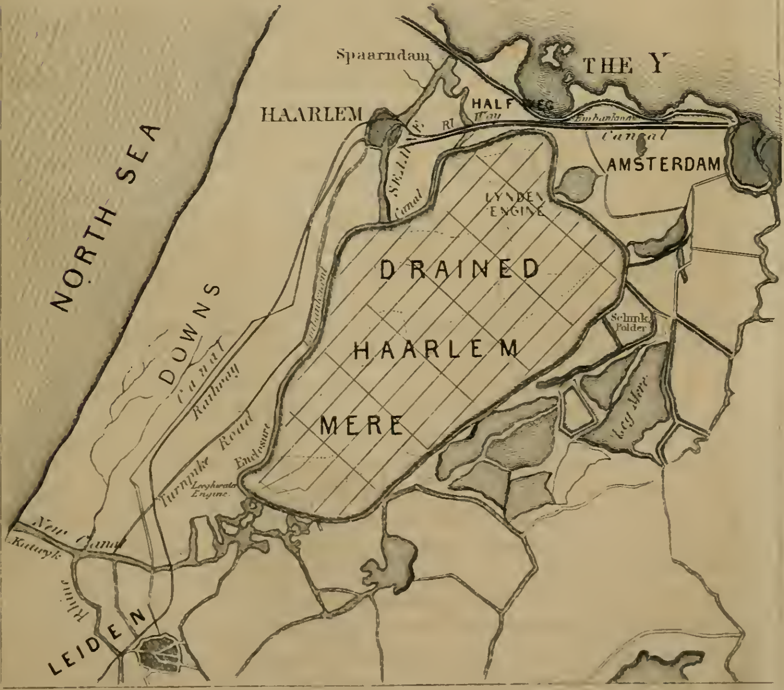
* This calculation of a horse-power, generally assumed in the decimal system, corresponds nearly with the one commonly used in England, it being reduced to English weights and measures, 32,549 lbs. raised 1 ft. per minute.

Drainage of the Haarlem Mere.





amount, in the first case, to 74,200 fl. (£6200), in the second to 54,000 fl. (£4500), and in the third case to 73,000 fl. (£6000).

The drainage by pumps, worked by single-acting steam-engines, offered an advantage in the expense of 2,500,000 fl. (£200,000), in favor of this system over that of drainage by wind-mills, while the difference of the yearly cost afterwards amounted to no less than 20,200 fl. (£1600).

It having been decided that the lake should be drained by single-acting engines, having suction-pumps, according to the results of the calculations mentioned, the general arrangements and details of the engine and pumps remained to be determined—a matter of no common interest.

The sub-Committee of the Commission which had made the above report, prepared a plan and made different experiments, to devise the best construction of buckets and foot-valves for pumps of the great dimensions required. At the same time, the English engineers, Messrs. Gibbs and Dean, who, as early as the year 1839, had presented to the government a plan of engines for draining the lake—which was then not approved of—offered a new plan of Cornish engines, applied to plunger-pumps, for the same purpose. In consequence thereof, it was resolved to charge the said engineers with the formation of a new plan, of which the principal points were prescribed by the sub-Committee, and accordingly the drawings were made. Eleven pumps were placed in the circumference of a circle, each pump being worked by a lever, and the opposite ends of these levers converging to the centre of the circle, where the steam cylinder was placed. On the top of the piston-rod a heavy weight was attached, which could be raised by the steam entering the cylinder from below, while the pump-buckets descended by their own weight. The piston having reached the top of the cylinder, the equilibrium valve had to be opened, allowing the weight to descend, carrying with it the eleven levers, which, at their other ends, raised the buckets. To take as much advantage as possible of the expansion, and diminishing, at the same time, the dead weight, it was proposed to adopt two cylinders, connecting their pistons in the manner suggested by Mr. Simms, but instead of placing them one above the other, which would have required a considerable height, they were to be placed *one within* the other, so that the outer cylinder was to be furnished with an annular piston, moving simultaneously with the solid piston of the inner cylinder. Working with eleven pumps, at each stroke 66 cubic met. (nearly 66 tons,) of water would be raised, which, for ten strokes per minute, would give 660 cubic met., or 950,400 cubic met. per day of twenty-four hours. The number of eleven pumps was adopted for the purpose of being able to work with a less number of pumps when the height to which the water had to be raised should increase, so that the working pumps would always balance each other; and that, finally, only three pumps should be worked, making, one with the other, an angle of 120°, and which, with ten strokes per minute, would raise 180 cubic met. per minute. After the drainage of the lake this quantity would have to be raised per minute to a height of about 5 met., corresponding with 900 cubic met. raised 1 met., corresponding with a power of 200 horses. If the double cylinder engine should realize the expectations, it would give out a power of 350 to 400 horses, so that, in such a case, six pumps would be moved—three on each side, balancing each other. It was, however, expected, and amply confirmed by the results, that more pumps, moved with a less velocity, would be preferable. This plan being adopted, the engine and pumps were contracted for by Messrs. Fox & Co., and Harvey & Co., in Cornwall, while the eleven pump-levers and the boilers were contracted for by Messrs. Paul van Vlissingen and Dudok van Heel, at Amsterdam. In the meanwhile the building was commenced on the south side of the mere, near the *Kager* Mere, on the spot marked on the map *the Leeghwater*—this being the name to be given to the first engine to be erected for executing the great work, of which two centuries ago, the idea was conceived and the plan made, by the enterprising man bearing the same name. Fig. 3 is a general plan (to a small scale), and Fig. 4 is a sectional elevation of engine-house, engine*, and pumps; the building consists of a round tower, in the centre of which the cylinder is placed, while it is surrounded, at some distance, by a

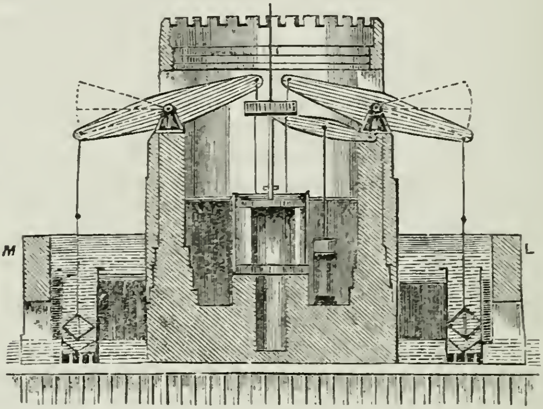


Fig. 3.—Sectional Elevation of Engine-house and Pumps.

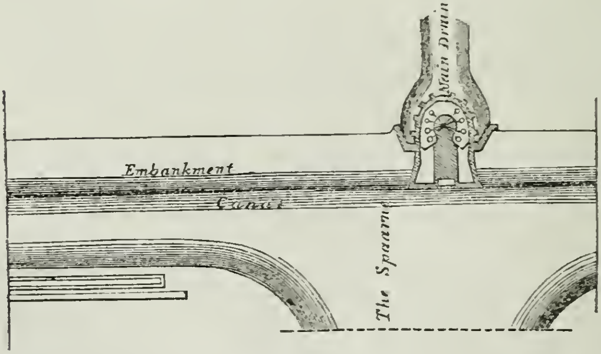


Fig. 4.—Plan.

* The sketch represents not *the Leeghwater*, but one of the two engines erected afterwards, with the different modifications which were considered necessary, of which the principal was the substituting eight pumps for the eleven, with an equal collective capacity.

strong wall, with arched apertures, to give access to the water. The foundation for this building was constructed by means of a heavy dam, and deepened out to about 7 met. (23 ft.) beneath the surface. No less than 1000 piles, of a length of 12 met., had to be driven in the bottom, while the tower had to be supported upon 400 oak piles. On the top of these piles a strong wooden platform was laid, on which the brick walls were erected, those of the tower having a thickness of 3·08 met. (9 ft. 10 in.) at the footing, while the thickness of the surrounding wall is 1·54 met. (5 ft. 2 in). The inside diameter of the tower, at the level of the floor, is 9·25 met. (30 ft. 4 in.), while the space between the outer wall of the tower and the inside of the surrounding wall measures 5·80 met. (19 ft).

The difference of the level of the canal, into which the water is discharged, amounts to 0·60 met. (nearly 2 ft.), the mean of which two levels we will take as the datum line for taking the measures of heights, and which we will call the mean level. (M.L.) In the space between the building and the surrounding wall, which rises to 1 met. (3 ft. 3 in.) above M.L., is laid a strong flooring of oak, at 1·33 met. (4 ft. 4 in.) below M.L. The pumps rest on bottom pieces, being open for the passage of the water; these bottom pieces, being set upon the wooden platform, which lies at a depth of 5 66 met. (18 ft. 7 in.) beneath M.L., while their heads pass through the flooring to a height of 0·78 met. (31 in.) below M.L., or 0·48 (19 in.) beneath the lowest level to which the water has to be raised. In the space between the building and the wall, above the floor, the water is received, and discharged on either side of the boiler-house by the sluice-gates corresponding with the canal, from which it is conveyed to the sea, at the different points, before indicated. The pumps of the *Leeghwater*, of which there are eleven, have a diameter of 1·60 met. (63 in.), while those of the two other engines, being eight in number for each engine, have a diameter of 1·85 met. (73 in.), the length of stroke of all the pumps being 3 met. (10 ft). The buckets and foot-valves may be described as butterfly-valves, being so constructed as to offer the greatest possible area for the passage of the water, for which purpose the valve on opening, rises with its hinges about 4 centim. ($1\frac{1}{2}$ in.), which, to a great extent, promotes, by the flow of water, the cleaning of the valves from the mud which may collect there. The valves are constructed of plate-iron, 26 millim. (1 in.) in thickness, and rest upon beds of wood lined with leather. Experiments which were made with the aim of ascertaining the loss by leakage of the valves, have shown that this loss amounted to no more than $\frac{1}{10}$th of the whole quantity. The pump-buckets are moved by the great levers, having a length from centre to centre of 10 met. (32 ft. 10 in.), and weighing each 10,000 kilos. (10 tons), and are connected thereto by rods, to the lower end of which are attached chains, which connect them with the buckets. The chain is for the purpose of preventing a shock to the bucket-valves when the steam-piston should happen to rise with too great a velocity, and, by the flexible chains, the buckets will descend by their own weight, without being affected by the velocity of the piston. The other ends of the levers are connected to the great cap surmounting the piston-rods by suitable straps. This cap, having a diameter of 2·8 met. (9 ft. 2 in.), is divided into eight chambers, containing the dead weight, amounting with the cap, to about 85,000 kilos. (85 tons). This cap is guided by the central piston-rod, which is lengthened above the cap, and moves through a stuffing-box in the beam by four guide-rods, two on each side of the cylinder. The engine has, as is stated above, two cylinders, one within the other, the outer being provided with an annular piston, which has a diameter of 3·66 met. (12 ft. $\frac{1}{4}$ in.), while the inner cylinder has a diameter of 2·14 met. (84$\frac{1}{4}$ in.), its thickness being 44 millim. (1$\frac{3}{4}$ in.), so that their respective areas are as 1 : 2·9 ; their stroke is the same as that of the pumps—viz: 3 met. (10 ft). The piston-rod of the central piston has a diameter of 30·5 centim. (12 in.), while the four piston-rods of the annular pistons have each 11·5 centim. (4$\frac{1}{2}$ in.) diameter. These four piston-rods are connected at their tops to the great cap, which, accordingly, by its ascending and descending, determines the motion of the pump-buckets. The manner in which the steam works in the cylinders is as follows:—The steam is admitted on the up-stroke, and the piston having reached the top, the equilibrium valve is opened, whereby the steam is allowed to enter at the top of the cylinder, diffusing itself not only at the top of the inner, but, at the same time, of the outer cylinder, while the upper edge of the inner cylinder does not reach to the under side of its cover, but leaves a space of 1$\frac{1}{2}$ in. The steam pressure, above and below the piston of the inner cylinder, being thus in equilibrium, the piston descends by the expanding steam acting on the annular piston, in this manner assisting the descent of the dead weight, which is reduced thereby in the same proportion. But the piston, which must remain stationary during some few seconds, to allow the valves of the pumps to close without a shock, should redescend before the opening of the equilibrium valves, the expanded steam in the small cylinder not having force enough to hold up the weight. To meet this difficulty a particular contrivance has been applied, which, in its general arrangement, may be described as a cataract. It consists of two plunger-pumps, having a diameter of 23 centim. (9 in.), attached to the extremities of the cap. When the piston ascends, these pumps are filled with water from pipes, having a height of 10 met. (32 ft. 10 in.), with which they communicate by valve-chests containing only suction-valves. At the top of these chests are pipes, which unite in a single valve-chest containing a valve, which can be lifted by a falling weight actuated by a cataract, which, at the same time, raises the equilibrium valve. When the piston has reached the top of the cylinder it remains stationary, on account of the plungers not being able to return until, by the action of the cataract, the valve is lifted and the water returns to the pipes. At the same time, the equilibrium valve is opened, allowing the steam to act upon the top of the pistons. During the short period of rest, the pump-buckets reach the bottoms of their respective pumps, while the valves are closed gradually. At first sight it may seem that the pumps to uphold the weight are superfluous, and that it would have been possible to omit them, by not expanding the steam in the inner cylinder, and proportioning the capacities of both cylinders in such a manner that the final expansion should take place in the outer cylinder. But it must be remembered that in such a case the difference between the initial and final pressure at the descending stroke would have been far too great, so that the piston would have descended with a velocity which would have been dangerous for the whole engine, and especially for the pumps, even so that with the actual arrangement a throttle-valve is placed in the equilibrium pipe to moderate the descent. The pressure at the commencement of the descending stroke is about 19 lbs. per sq. in. (the habitual working pressure being three atmospheres), and the pressure at the end of the stroke is 8 lbs. per sq. in., giving a difference of 11 lbs.; while, with another proportion between the capacities of the cylinders, the end pressure remaining the same, the initial pressure would have been 30 lbs., giving a difference of 22 lbs., or double that of the actual pressure.

The engine has two air-pumps, one of which is indicated in the sketch, each being actuated by a lever which is connected to the cap; they have a diameter of 1·02 met. (40 in.), and 1·52 met. (5 ft.) stroke. The *Leeghwater* has five boilers, but the two latter engines erected have each six of the same dimensions; the sixth boiler being added, not from any want of steam, but so as to have a greater boiler-room, whereby the advantage of a slow combustion could be obtained. The boilers are contained in the boiler-house, indicated in the plan, Fig. 4, and are cylindrical, with internal flues. They have a diameter of 1·82 met. (6 ft.), the diameter of the flues being 1·22 met. (4 ft.), and their length 9·15 met. (30 ft). A cylindrical steam chamber, having a length of 12·80 met. (42 ft.), and a diameter of 1·37 met. (4 ft. 6 in.), is placed transversely over the boilers, communicating with each of them by a particular stop-valve. The steam pipe to the cylinder has a diameter of 0·61 met. (2 ft). The contract price for the building was 161,000 fl. (£13,800), while the engine and boilers have required an expense of 207,050 fl. (£17,254). Experiments conducted by the sub-Committee to test the power and economy of the engine, show that the engine is capable of giving out a net power of 500 horses, and even more. At the most favorable experiment the consumption of fuel was 1·17 kilos. (2·6 lbs.) per H. P. per hour, and the duty 70,000,000 lbs. raised one foot high by the consumption of 94 lbs. of coal. In many of the engines in Cornwall the highest duty is considerably more, even as high as 100,000,000 lbs.; but it must not be overlooked that the motion imparted to the water requires a certain force, which remains constant at all heights. Accordingly this force, while it bears but a very small proportion to the total power to be expended when the water has to be raised to a very great height, as is the case in mines, bears a far greater proportion to the force required when the water has to be raised to no more than 5 met. ($16\frac{1}{2}$ ft.), and may considerably affect the economy of the engine. It is most difficult to estimate the value of this force, no experiments having been made which can be fully relied upon. For testing the power of the engine an experiment was made with the eleven pumps, raising the water to a height of 5 met ($16\frac{1}{2}$ ft.), that being the maximum height to which the water was to be lifted after the drainage. The number of strokes at that time being eight, the net power—deducting $\frac{1}{10}$th for the loss by leakage—was 528 H. P. This number of strokes with such a load, and even with a less height, was considered unsafe, and was not required, so that generally the number of strokes has been from five to seven.

In the month of November, 1845, the *Leeghwater* was ready, and the drainage might have been commenced if no great difficulties had arisen between the direction of the district *Rhynland* and the commission about the height to which the canal (being part of the *boezem* of the said district) would have to be raised by the action of the engines. This question was not settled until the latter part of the year 1847, at the commencement of the winter, when the *boezem* was at a high level, so that had pumping been commenced at that time the water pumped out during the winter would have been discharged, naturally, in the spring, when the *boezem* stands always on a lower level.

(To be Continued.)

AMERICAN PATENTS.

List of American Patents which issued from October 7th, to October 28th, 1856, (*inclusive,*) *with Exemplifications.*

OCTOBER 7.

1. For an *Improved Ring-bolt for Ships' and Boats' Tackle;* Hubbard Bigelow and Mortimer M. Camp, New Haven, Connecticut.

Claim.—"The tongue, the hold-fast, and the levers, as arranged in relation to the body."

2. For an *Improvement in Soda Fountains;* John F. Boynton, Syracuse, New York.

Claim.—"The arrangement of the plunger and vessel, whereby the acid may be measured and delivered to the other ingredients in determinate quantities Also, the spring drip valve, or its equivalent, whereby the vessel is entirely emptied of acid after a charge is worked off."

3. For an *Improvement in Bumper Arrangement for Uncoupling Railroad Cars;* William O. George, Richmond, Virginia.

Claim.—"The arrangement of sliding rods, running longitudinally beneath the platforms of railroad cars, so connected with the coupling pins of different cars, that they may be simultaneously detached from each other by simple contact of the sliding rods, at the same time that the engineer or conductor is enabled to disconnect one or more of the cars if desired."

4. For an *Improvement in Vegetable Cutters;* George W. Childs, Liberty, Penna.

Claim.—"The vibrating cross knives."

5. For an *Improvement in Smut Mills;* Joel W. Cormack, Quincy, Illinois.

Claim.—"The combination of the cones and creepers, arranged and operating in connexion with the flanched rims, attached to the cones."

6. For an *Improved Machine for Folding Paper;* Cyrus Chambers, Jr., Kennett Square, Pennsylvania.

Claim.—"1st, Causing a folding machine to make the crease for the fold in paper, or other substances, so that any number of sheets fed successively to the said machine, may be folded to correspond to the printing, or other impressions made thereon by means of the points or register pins, or their equivalents, and the holes by which the sheet was registered upon the press; or the holes or marks made in the sheet for any other purpose. The said pins being adapted to the said holes or marks, and the sheet or substance to be folded, placed upon the said pins by using the said holes or marks for that purpose. 2d, The manner of adjusting the register pins, and their peculiar movement. 3d, Supplying the straight edge or blade, or its equivalent (which forces the paper into recesses or between converging surfaces, or their equivalents), with fine points. 4th, The bars and the stops, independent of, and in combination with, each other, as well as the bars, or the stops, separately or combined, in combination with the endless belts. 5th, Arranging the rollers, which make the second fold below the rollers; which make the first fold, and the rollers; which make the third fold below; and in like manner any number of rollers, so that the substance to be folded may be forced downwards between each pair, thereby enabling a single series of endless belts, or their equivalents, to conduct it from one pair of rollers, and present it for the action of the next. 6th, The fly, in combination with the endless belts, and the mode of making the support of the said fly adjustable; also, the manner of moving the said endless belt. 7th, Arranging a single series of endless belts, so that paper, or other substances, may be conducted by them horizontally from a pair of rollers when passing downwards between them. 8th, Gearing the rollers in such manner as to decrease the speed of the periphery of each successive pair, in the proportion specified. 9th, Controlling the first blade or plate of folding machines, by a treadle or other means."

7. For an *Improvement in Harvesters;* William Dripps, Coatesville, Pennsylvania.

Claim.—"Giving to the cutters of a harvesting machine, a traveling and a rotating motion at the same time."

8. For an *Improvement in the Construction of Hide Frames in Tan Vats;* Elias A. Eliason, Georgetown, D. C.

Claim.—"Arranging a series of ranges of horizontal slats in a false vat or frame upon which the hides are placed, one upon every range, whereby the whole may be simultaneously raised out of the liquor vat (without pumping off the liquor). Also, the axial cross ties, when connected with the frame, in combination with the hooked rods and shaft, whereby the frame or false vat may be revolved or reversed."

9. For an *Improvement in Buoys:* William M. Ellis, Washington, D. C.

Claim.—"1st, The method of mooring buoys, beacons, and floating bodies, by having their cables attached to said bodies, in the line of their calculated centre of tidal pressure. 2d, The method of connecting the forked or V link or shackle to the said buoy, or floating body, by means of a trunnion bolt passing through a metallic tube or pipe, properly set and secured within the said body."

10. For an *Improvement in Hose Coupling;* L. M. Fevry, Assignor to James T. Ames, Chicopee, Massachusetts.

Claim.—"The combination and the application of the various devices for the purpose of coupling firemen's hose."

11. For an *Improvement in Machines for Mixing Mortar;* Benjamin F. Field, Beloit, Wisconsin.

Claim.—"The use of a revolving box of a cylindrical or other form, made to roll upon the ground for the purposes of mixing the mortar by the action of the cross-rods, whilst at the same time it serves to carry the material from place to place, in combination with the method for discharging the mortar from the revolving box."

12. For an *Improved Fly-Trap;* George Gilbert, Westville, Connecticut.

Claim.—"The combination of the revolving cylinder with the screens or wire work."

13. For an *Improvement in Attaching Scythes to Snaths;* David A. Goodnow, Baldwinville, Massachusetts.

Claim.—"The screw and dog, in combination with projection."

14. For an *Improved Arrangement of Elastic Plate-Paddles for Steam Vessels;* Auguste Jouan, San Francisco, California.

Claim.—"The series of vertically divided elastic plate paddles."

15. For an *Improvement in Feeding Pulp to Paper Making Machines;* Israel Kinsey, Hohokus, New Jersey.

Claim.—"Regulating the flow of pulp for making paper, upon the web or cylinder of the paper machine, by the pressure of the pulp in a box receiving its supply of pulp from the stuff-chest, through the aperture in the trunk, and discharging it through an adjustable aperture below the surface of the pulp in the box; the pressure being regulated and kept uniform by the height of the pulp in the box, which is adjusted and maintained by means of a valve, fitting the aperture operated by a float; the combination of the several parts forming a self-acting regulator for the purpose of making paper of equal thickness."

16. For an *Improved Method of Bending Wood;* Edwin Kilburn, Artemas Kilburn, and Cheney Kilburn, Burlington, Vermont.

Claim.—"The bending of wood by forcing it endwise of its fibres into a mould, which is closed on all its sides, but has an open end, is curved longitudinally in the required form, and has the dimensions of its internal transverse section of the piece of wood, thus causing the wood to be confined in a lateral direction during the bending process, for the purpose of preventing the separation of the fibres."

17. For an *Improved Method of Measuring Fluids while Drawing;* Samuel Krauser, Reading, Pennsylvania.

Claim.—"Severing or separating a given quantity of liquid from a mass or column, by a traveling tube and plunger. Also, the gauge plates, in combination with the valve seat or packing of the plunger fitting thereto, for adjusting the measuring apparatus to the exact quantity to be drawn."

18. For a *Plate-Holder for Photographic Cameras;* William and William H. Lewis, Assignors to Malonzo J. Drummond, City of New York.

Claim.—"Forming the glass or vitrified corners, with a flanch or rim in one solid piece, the said flanch or rim taking the edges of the photographic glass or other plate, and irrespective of the manner in which the said vitrified corners are attached to the frame. Also, the receptacle below the glass or other plate to catch any drippings from said plate.".

19. For an *Improvement in Harvesters;* Israel S. Love, Beloit, Wisconsin.

Claim.—"The use of the movable rolling guides, placed between the cutting blades and the sill of the harvesters, whether they be used with a sill made entirely of metal, or partly of wood, with more or less metal attached to the same."

20. For an *Improvement in Machinery for Cleaning Wool;* Andrew W. Putnam, Brooklyn, New York.

Claim.—"The combination of the main picker cylinder, and the open and closed concave, in combination with the burring cylinder. Also, the burring cylinder, in combination with the adjustable burring bar or bars, for stripping the burrs and other foreign substances on the fibres."

21. For an *Improved Sash Lock;* Owen Redmond, Rochester, New York.

Claim.—"The swinging bolt, in combination with the slide and case, so that the gravity of the slide shall shoot the bolts, and maintain it in position."

22. For an *Improvement in Glass or Earthen Truss Pads;* Charles C. Reinhardt, Baltimore, Maryland.

Claim.—"The attachment of metallic backs to the glass faces of truss pads, by a flanch around the edge of the back, slipping within the rim constituting the edge of the glass face piece."

23. For an *Improved Machine for Cuttting Irregular Forms;* Charles Spofford, Amesbury, Massachusetts.

Claim.—"The combination of a vibratory spring presser, with a rotary cutter, stock, and two tables, the said presser being made to operate with respect to the cutter stock, and table, and either guide. Also, the combination of mechanism for moving the vibratory spring presser and its spring towards either of the tables, and locking the shaft to the spring, the same consisting of the arm, the two turning bearers, and the treadle or lever connected to the bearers by pitmen. And, in combination with the mechanism for moving the vibratory presser and its spring, towards either of the tables, and locking the shaft to the spring, the auxiliary treadle applied to the main treadle, and supported by a swinging bar."

24. For an *Improved Machine for Finishing Gas Pipe Fittings;* Caleb C. Walworth, Boston, Massachusetts.

Claim.—"The arrangement and combination of the machines operating in a plane around a common centre, for the purpose of screwing or tapping different ends of gas pipe fittings at the same time, when connected by means of a wrist plate, and slotted connexion, or their equivalents, for the purpose of bringing the taps to their work, and yet permit either of them to advance or recede without interfering with the others."

25. For an *Improvement in Nut Machines;* Wm. E. Ward, Port Chester, New York.

Claim.—"The two punches arranged side by side, and operated for punching the central hole, cutting off the blanks from the bar, and discharging the same, in combination with the two holes or two dies, so that a hole is punched in the bar for another nut during the continued motion of the punch to discharge the nut which was cut off during the previous part of the same motion. Also, in combination with the punching and cutting operation, or either, and with the mandrel, or its equivalent, for entering the central hole of the nut blank, the employment of the spring jaws, or the equivalent thereof, for transferring the nut blank from the die to the mandrel, and there holding it until the mandrel enters the hole. Also, the holding of the nut blanks on the mandrel, in combination with the swages for swaging the faces of the nuts. Also, in combination with the mandrel for holding and turning the nut blanks, the employment of the hammers for hammering or swaging the edges of the nuts. And, finally, the combination of the swages for swaging the faces of the nuts, with the hammers for forging the edges of the nuts, by means of which the metal is thoroughly compacted in all directions and a good finish given the entire blank."

26. For an *Improved Vice;* Caleb C. Walworth, Boston, Massachusetts.

Claim.—"The arrangement of two vices so as to revolve about a common centre, and locking the same in any desired position by means of the lever and notches, or any other suitable device."

27. For an *Improvement in Brick Machines;* George J. Washburn and Ephraim H. Bellows, Worcester, Massachusetts.

Claim.—"The combination of a balanced arm with the weighted reciprocating plunger. Also, the means by which the plunger is locked with, and disconnected from, the cylinder, consisting essentially of the pins and the arms."

28. For an *Improved Bracket for Door Springs;* Alexander J. Walker, City of New York.

Claim.—"Constructing one of the brackets used for attaching such rods with an additional hole for receiving and holding them when in operation, said additional hole bearing such a relation to the first, that by changing the spring from one to the other, greater nicety can be observed when applying it, in regulating the power with which it shall act, and of attaching to said bracket a lever to assist in twisting the spring when applying it. Also, securing said bracket in its place by means of a socket inserted in the door or casing, or any other means substantially the same, that will instantly secure it after it has been applied to the spring, and the necessary power obtained, and will also allow of its being easily removed and re-attached when it is desirable, either to alter or entirely remove the power."

29. For an *Improved Hoop Machine;* William B. Wood, Fitchburgh, Massachusetts.

Claim.—"The peculiar arrangement of the several parts of the machine, for the purpose of splitting the poles and shaving the hoops at one operation."

30. For an *Improvement in Pincers for Lasting Boots and Shoes;* Benj. F. Sturtevant, Skohegan, Maine, Assignor to Elmer Townsend, Boston, Massachusetts.

Claim.—"The instrument for lasting boots."

31. For an *Improvement in Cutting Round Files;* Milton D. Whipple, Charlestown, Assignor to A. B. Ely, Newton, Massachusetts.

Claim.—"1st, Operating upon the blank immediately beyond its point of support. 2d Feeding the blank forward, and rotating upon its axis as the cutting proceeds, when it is operated upon by the vibrating cutters. 3d, The method of operating the cutters by means of the wipers and the springs, whereby the force of the blow is diminished as the size of the blank decreases. 4th, Forming the cutters of circular disks, or of portions thereof."

32. For an *Improvement in Mill Stone Dress;* W. P. Coleman, New Orleans, La.

Claim.—"Forming the master and subordinate furrows of the stones as described, viz: the straight portions of the furrows being tangential with the eye, and with circles concentric therewith, and the curved portions being segments of a circle of equal curvature, or thereabouts, to that of the outer peripheries of the stones, for the purpose of rapidly throwing the grain outwards in the early action of the furrows, and retarding or gathering it in by the after or outer portions thereof."

33. For an *Improvement in Coiled Springs for Railroad Cars;* Carls French, Seymour, Connecticut.

Claim.—"Composing the coiled leaf of two or more leaves, placed the one below the other, said component leaves being welded together at one or both ends thereof."

OCTOBER 14.

34. For an *Arrangement of Means for Regulating the Draft of Steam Boilers;* Pliny E. Chase, Philadelphia, Pennsylvania.

Claim.—"The apparatus when constructed and arranged so that the action of the steam in the boiler, when at or above the maximum pressure desired, will cause the draft through the fire-box to be reversed, and pass down through the fire, and again resume its former course in the opposite direction when the pressure is reduced to the minimum."

35. For an *Improvement in Sticking Pins in Paper;* Lydia Atwood and C. O. Crosby, Administrators of Charles Atwood, dec'd., City of New York.

Claim.—"1st, The vibrating nippers, armed with a knife, or double inclined plane, for separating the pins, turning them from a vertical to a horizontal position. 2d, The straight inclined conductor, when combined with the nippers, with their separating points as carrier. 3d, The lipped driver, for driving the pin along a railway or bed laterally into the groove to be stuck into the paper, when it acts upon the pin before the vibrating nipper lets go its hold. 4th, The lateral driver, or its equivalent, for the purpose of delivering the pin under the spring holder, as a means of controlling the pin, until it is inserted into the paper. 5th, The combination of the sticking driver and its guiding groove, with the vertical crimping bars, when the bars permit the paper to pass over their ends vertically in the process of sticking pins. 6th, The feeding rollers, or their equivalents, for the purpose of holding the paper, and controlling it at such a distance from the guiding rollers, as will allow the paper to pass up and down without moving the spools, while the rollers are in motion. 7th, The rollers and carriages which control the pins and the paper, for the purpose of moving the paper forward intermittently, to space off the rows of pins, and to space the distance between each succeeding pin in the same row, the ends of the paper resting on spools dissected from the machine."

36. For an *Improvement in Guides for Working Button Holes;* Otis Avery, Bethany, Pennsylvania.

Claim.—"The combination of the sliding plate with the revolving tweezers."

37. For an *Improved Canal Bridge;* Balaam G. Anderson, Chillicothe, Ohio.

Claim.—"Constructing the bridge of three parts, the parts being connected by joints to the part, and having their supports provided with rollers which work on curved ways at the bottom of the canal."

38. For an *Improvement in Papering Pins;* Lydia Atwood and C. O. Crosby, Administrators of Charles Atwood, dec'd., City of New York.

Claim.—"Fabricating a new article of manufacture, called diamond pin cushions, by sticking pins in ranks or rows through a staple, or U shaped piece of paper, the heads of the pins projecting sufficiently far to allow the pins to be easily and conveniently withdrawn by the fingers for use. The pins being inserted upon two planes of the paper, with the heads projecting beyond the points a suitable distance to protect the points from being doubled or blunted, all the other portions of the pins being protected by the paper, and sustained by it at a short distance from the heads and points by the paper, making a solid mass of pins set in diamonds with regard to each other, but not in contact, and which usually contains the requisite quantity of pins for an ordinary paper for toilet use in a small compass."

39. For an *Improvement in Excavators;* James Beurbin, San Francisco, California.

Claim.—"The application of any number of shovels required, and working from one centre on the circular principle. Also, the different appliances by which the shovels are directed in their movements."

40. For an *Improved Manure Distributor;* J. W. Barnes, Murfreesboro', N. Carolina.

Claim.—"The hinged side, combined with the hinged bottom."

41. For an *Improvement in Sticking Pins in Paper;* Walker B. Bartram, Waterbury, Connecticut.

Claim.—"1st, The separator or spacer, composed of a series of bars, having a simultaneous movement at right angles or nearly so to the line of pins in the pin feeder, and to the line in which the pins are inserted, and a movement one after the other in a direction parallel or nearly so to the said line. 2d, The construction of the driver, with recesses in its face to receive the heads of the pins, and act in conjunction with the paper after the points of the pins have penetrated it, to serve the purpose of guiding the pins straight and parallel through the paper, thus enabling the holder to be opened to make room for the driver. 3d, The stop, acting in combination with the separator and spacer, to retain the pins behind the separator and spacer, after a number sufficient for one row has been taken from the feeder by the separator and spacer, but to be moved away by the separator and spacer. 4th, The bar, operating in combination with the forceps, to form a second holder below the principal holder, and more perfectly secure the upright and parallel positions of the pins during the commencement of the driving operation."

42. For an *Improved Pump;* William T. Barnes, Buffalo, N. York, and Jacob Barnes, Oakville, Canada West.

Claim.—"The employment of the priming reservoir, or its equivalent, which is connected to the pump, and fills it with water by the action of the pump, which water is held by the supporting box, or its equivalent, and can be discharged to prime the pump by pulling the cord, or its equivalent. 2d, The combination of the levers, with the piston rods, and the connecting rods, and rocking beam."

43. For an *Improvement in Grain Separators;* Joel W. Cormack and F. C. Walker, Quincy, Illinois.

Claim.—"The cylindrical cheat box, into which the air tube enters. Also, the flanches and funnel, or their equivalent, in combination with the tube, for the purpose of creating the spiral or whirlwind blast in a grain separator."

44. For an *Improvement in Axe Polls;* David P. Estep, Pittsburgh, Pennsylvania.

Claim.—"The manufacture of axe polls by compressing one-half only of the axe poll at each operation, between dies or swages of the shape described, projecting from the face of the rolls in which they are set, so that the axe poll can be inserted and withdrawn without coming in contact with the rolls, in combination with the use of the adjustable guide, either attached to the dies or separate therefrom, for the purpose of applying the pressure necessary to form the axe poll, in such a manner as to leave an excess or deficiency of iron in the head of the axe poll, thus securing exact uniformity in the two sides of the axe poll, and enabling axes of various sizes to be made from the same dies by simply adjusting the distance of the rolls and the gauge."

45. For an *Improved Method of Opening and Closing Farm Gates;* Dennis E. Fenn, Talmadge, Ohio.

Claim.—"The cam, with its alternate elevations and depressions, in combination with the arm and double jointed hinge."

46. For an *Improvement in Harvesters;* Carlos W. Glover, Roxbury, Connecticut.

Claim.—"Attaching the finger bar to the guide box, which is fitted over the flanch of the driving wheel, the guide box having the two shafts attached to it, by which motion is communicated to the sickle from the driving wheel, and the bar attached to the finger bar by hinges or joints, and the guide box to the rod."

47. For an *Improved Firemen's Ladder;* Domenico Giambastiani, Washington, D. C.

Claim.—"The combination of the foundation frame, with the detachable single ladder sections."

48. For an *Improvement in Salt Evaporators;* James L. Humphrey, Syracuse, N. Y.

Claim.—"The arrangement of the furnace, the closed evaporating vessel, the flues, the blower, and the chimney, whereby the products of combustion are drawn through the evaporating vessel below the surface of the liquid to produce evaporation by heat, and afterwards driven in the opposite direction over the surface of the liquid to produce further evaporation, and carry off the evaporation to the chimney. Also, the scraper fitted to the flues and pipes which pass through the liquid in the evaporating vessel."

49. For an *Improved Arrangement of Springs for Side Spar Wagons;* M. G. Hubbard, Penn Yan, New York.

Claim.—"The mode of combining the two semi-elliptic springs with the side spars of light wagons, by bringing one above, and the other below the end of said spar."

50. For an *Improvement in Anti-Friction Bushing for Ships' Blocks;* James Kelley, Sag Harbor, New York.

Claim.—"The mode of constructing the bush by riveting the head within the cylinder, and the annular grooves for the reception of the bearing rings of the rollers."

51. For an *Improvement in Ploughs;* Samuel A. Knox, Worcester, Massachusetts.

Claim.—"The form of the working surface of the mould board of ploughs, and composed or combined of the several characteristic features specified."

52. For an *Improvement in Pumps;* Edwin T. Ligon, Richmond, Virginia.

Claim.—"The combination and arrangement of the two induction passages or branches, the valve chambers, their four valves, the receiving and delivering chambers, their four valve openings, provided with a separate valve to each, or one vibrating plate made to operate between them, the piston being provided with an eduction opening or passage, and the whole being arranged and made to operate within a cylindrical case. Also, combining and arranging four valve openings with one vibrating plate, so that it may vibrate between them and opposite sides of it, and cover two of them at the termination of each of its vibrations."

53. For an *Improvement in Escapement Movements for Automatic Fans;* Don J. Mozart, Xenia, Ohio.

Claim.—"In combination with the sectional scape wheel, the banking pin meeting the sections thereof at each vibration."

54. For an *Improved Method of Hanging Reciprocating Saws,* John H. More, West Troy, New York.

Claim.—"The hinged jaws and screws. Also, the finished faces on the jaws of the fixed body of the stirrup, in combination with the hinged jaws."

55. For an *Improvement in Porte-Monnaies;* John L. Mason, Germantown, Penna.

Claim.—"The construction of the whole of the pockets of a porte-monnaie, or other article of similar character, from a single piece of leather by a system of folding."

56. For an *Improvement in Sawing Stone;* John North, Middletown, Connecticut.

Claim.—"The two inclined reciprocating saws connected with one and the same rotating driving shaft, by the oblique connecting rods, each rod having four joints."

57. For an *Improved Adjustable Stirrup for Saw Mill Pitmen;* Samuel C. Norcross, Dixfield, Maine.

Claim.—"The manner of attaching the stirrup to the pitman, whereby its position on the pitman, and consequently the length of the pitman, may be varied for the purpose of altering the position of the saw with respect to the log."

58. For an *Improvement in Bee Hives;* Charles Pawling, New Pittsburgh, Ohio.

Claim.—"The arrangement of the bee entrances, with the moth entrances, and moth receptacles."

59. For an *Improvement in Washing Machines;* Jacob Purkey, York, Pennsylvania.

Claim.—"The reciprocating corrugated or fluted board or rubber, in combination with the rollers, the rollers being attached to the chains."

60. For an *Improvement in the Order of Applying Tan Liquor to Hides;* Samuel W. Pingree, Methuen, Massachusetts.

Claim.—"The use of the catechu and the sumac and alum, with reference to the application of the bark or strong tanning liquor as stated, and so as to produce effects as set forth, when the hide is tanned with hair on it."

61. For an *Improvement in Uterine Supporters;* Wm. Provines, Columbia, Missouri.

Claim.—"The combination of the ball and the valve apparatus."

62. For an *Improvement in Submarine Exploring Armor;* Lodner D. Phillips, Chicago, Illinois.

Claim.—"1st, A submarine armor with which the explorer can be wholly invested, composed entirely of metal, having free and easily moving jointed limbs, and from within which the explorer may give motion to the armor, and operate the external means. 2d, Connecting with such armor, a collapsible exterior vessel, so united with the interior air chamber as to allow of its being inflated, and buoy up the armor. 3d, Arranging the rods for operating the exernal tongs or nippers within the tubular arms."

63. For an *Improved Machine for Bending Metal Pipe;* James Perkins and Wm. H. Burnet, Newark, New Jersey.

Claim.—"The mandrel, with the traversing roller, or its equivalent, for bending coils of metal pipe, and in combination therewith the furnace."

64. For an *Improvement in Spring Bed Bottoms;* Charles Schroder, City of N. Y.

Claim.—"The arrangement of springs lying horizontally and connected together."

65. For an *Improved Wheelwright's Machine;* John Sitton, Williamston, N. C.

Claim.—"The several devices when combined and operated."

66. For an *Improvement in Finishing Caster Wheels for Furniture;* Philos B. Tyler, Springfield, Massachusetts.

Claim.—"Finishing caster rollers, and like articles made of cast metal, by stamping them in dies, whereby in finishing the die is hardened, and its thickness determined with exactness, insuring the maximum amount of strength with the smallest weight of material."

67. For an *Improvement in Machinery for Forming Hat Bodies;* James S. Taylor, Danbury, Connecticut.

Claim.—"1st, The revolving feed table, in combination with the picker, cone, and exhaust. 2d, The combination of the revolving brush with revolving perforated cone, for the purpose of moistening the fur as it is thrown upon the cone."

68. For an *Improvement in Manufacturing Cylinders for Cotton Gins and Machine Cards;* John L. Tuttle, City of New York.

Claim.—"The manner of making cylinders for cotton gins, or for carding or cleaning engines, viz: by introducing the fluid metal, which is to unite the teeth to the cylinder, between the cylinders, and through the openings into the space, which unites the whole into one rigid mass, and avoids the danger of irregular flowing of the melted metal."

69. For an *Improvement in Card Teeth for Machine Cases;* John L. Tuttle, City of New York.

Claim.—"The making of card teeth by giving to steel wire the form described, so that when set, and a surface ground on them, the same grinding shall form the sharp points thereon."

70. For an *Improvement in Cotton Gins;* John L. Tuttle, City of New York.

Claim.—"The combined use of the straight edge and roller, for stopping and returning the cotton seeds to the breast of the machine, and allowing the fibre only to pass through."

71. For an *Improvement in Gimlet Handles;* G. H. Talbot, Boston, Massachusetts.

Claim.—"The application within the stock or handle of the gimlet, or other tool or instrument, of arrangement of ratchet or rag wheel gearing, operating so as to enable the tool or instrument to be rotated in another direction at the pleasure of the operator, by turning the handles back and forth in opposite directions, and at the same time pushing it from, or pulling it towards him, the direction of the rotation being varied by the pushing or pulling of the stock or handle."

72. For an *Improved Arrangement of the Thills of Vehicles;* Noah Warlick, Lafayette, Alabama.

Claim.—"The swinging frame composed of bars and braces, adapted to the reception of either thills or pole."

73. For an *Improvement in Railroad Car Coupling;* John C. Ward, Charleston, South Carolina.

Claim.—"The weighted arm, stud, and slide catch, in combination with the partially rotating tumbler, when said tumbler constitutes the securing socket."

74. For an *Improvement in Nail Machines;* Perry A. Wilbur, New Castle, Penna.

Claim.—"The arrangement of the cutting, griping, heading, and delivery apparatus, with regard to the nail plate feeder, so that the whole may be operated from one cam shaft."

75. For an *Improved Fastening for Gates;* Smith Young, Milton, New York.

Claim.—"The employment of two pivoted spring catches on the post, in combination with a stationary central stop, and two hand levers on the front edge of the gate."

76. For an *Improved Machine for Cleaning Emery Wheels;* Stephen A. Whipple, Shaftsbury, Vt.. and Herman Whipple, Port Richmond, New York.

Claim.—"The use of the roller, revolving in contact with water, and the superincumbent wheel."

77. For an *Improved Method of Felling Trees;* Simon Ingersoll. Assignor to the Farmers' and Mechanics' Manufacturing Co., Green Point, New York.

Claim.—"Attaching the saw to the bar, which is connected with the levers and bars, the bar being connected with the spring."

78. For an *Improved Brace for Carriage Springs;* Thomas Dutton, Assignor to J. R. Elvans, Washington, D. C.

Claim.—"The combination of the brace rod with the toggle joint and lever, or any of their equivalents."

79. For a *Hinge for Picture Cases;* Alfred Critchlow, Assignor to A. P. Critchlow & Co., Florence, Massachusetts.

Claim.—"The application of a hinge of a daguerreotype or picture case, moulded of a plastic material, made of a frangible substance or substances, such hinge being made with each of its leaves bent twice. and so applied to the halves of the box, that it may embrace two contiguous sides of such halves, and be independent thereof, and extend or lap over, and be fastened to the top and bottom plates of said box."

80. For an *Improved Chimney Cowl;* Thomas W. Chatfield, Utica. New York.

Claim.—"The use of two inverted funnels, together with the short cylinder."

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81. For an *Improvement in Grain Threshing and Separating Machines;* John Barnes, Mount Morris, New York.

Claim.—"The arrangement in its transverse relationship to the screen, and across the mouth thereof, of the threshing cylinder, on the falling side of the screen when in motion, or mainly on said side, in combination with the introduction of the blast (by branch,) on the rising side of said screen, and between said side and the inner end of the cylinder's throw or action, for the better clearance of the grain from under the cope, and the more easy and effectual separation of the grain as it rises and falls, and is kept free and loose by the lift of the screen."

82. For an *Improvement in Cotton Seed Planters;* Charles R. Belt, Washington, District of Columbia.

Claim.—"Effecting the seed discharge by the opposite reciprocation of the inclined plates, constituting the bottom of the hopper, in combination with the armed rollers, or its equivalent."

83. For an *Improved Apparatus for Cleaning Coulters or Ploughs;* Edmund C. Bills, Jr., Perry, New York.

Claim.—"The employment upon the front of the coulter of an inverted cone, having spiral flanches thereon, self-acting by the upward pressure of the grass to free the coulter."

84. For an *Improvement in Corn Shellers;* William Black, Allegheny City, Penna.

Claim.—"Two or more holes of different sizes, with teeth converging."

85. For a *Reed for Musical Instruments;* J. C. Briggs, Woodbury, Connecticut.

Claim.—"The reed, constructed of a ring or frame, with a vibrator, consisting of a disk or plate suspended by a central stem from a spring, to vibrate within the said ring or frame in right lines perpendicular to the plane of the disk, thereby enabling a column of air of uniform thickness in all parts to be admitted through the reed, and enabling a uniform vibration to be produced all round the reed."

86. For an *Improvement in Pumps;* John P. Cowing, Seneca Falls, New York.

Claim.—"The auxiliary cylinder placed on top of the pump cylinder, and so arranged as to form a reservoir for oil or water around the stuffing box and piston, and at the same time to support a guide for the piston, which may be turned in any desired position."

87. For an *Improvement in Carriages;* Daniel Freeman, Burford, Canada.

Claim.—"The combination and arrangement of the body supported by, and distributing its weight upon, all four springs, when placed above the axles. Also, the arrangement of the draw bar and brace, by which the former is connected directly with the centre of the fore axle. Also, the arrangement of the fifth wheel or circle, upon the lower of the two front springs. Also, making the head block elastic."

88. For *Bituminous Ground for Photographic Pictures;* Victor M. Griswold, Lancaster, Ohio.

Claim.—"Taking photogenic pictures on paper or other substance, prepared by the above process."

89. For an *Improved Fire Arm;* Alexander Le Mot, New Orleans, La.

Claim.—"1st, The substitution of a shot barrel to the solid cylinder or pin, upon which the revolving cartridge cylinder revolves, constructed upon Colt's or other systems of revolve. 2d, The gun cock with a double hammer."

90. For an *Improvement in Sickles for Harvesters;* Pells Manny, Waddam's Grove, Illinois.

Claim.—"The arrangement at the back of the cutter bar, and for reciprocating operation with it, of a back set of cutters or clearers between the finger and cutter bars, when said teeth are shaped and arranged to cut laterally forwards, alternating in opposite directions through or over the backs of the fingers for joint action with the front cutter or cutters, for the better clearance of the fingers and cutter bar race."

91. For an *Improvement in Harvesters;* Pells Manny, Waddam's Grove, Illinois.

Claim.—"The straining stirrup or brace bar, arranged diagonally beneath the frame, and fitted so as to secure the ready and effectual adjustment of the frame or finger bar portion thereof."

92. For an *Improved Spike Machine;* C. A. McPhetridge, St. Louis, Missouri.

Claim.—"The conducting arms as constructed, when operating in connexion with the means employed for cutting, pointing, heading, and clearing, and the closing guides. Also, the use of the feed rollers, the ratchet wheel, bar, pinion, pawl, in connexion with the wheels and the pin."

93. For an *Improvement in Sizing Hat Bodies;* Joseph McCraken, Brooklyn, N. Y.

Claim.—"The use of the india rubber or other elastic perforated cylindrical roller, for working or sizing hat bodies upon."

94. For an *Improvement in Cotton Gins;* James B. Mell, Riceboro,' Georgia.

Claim.—"The arrangement of two or more sets of ginning rollers in an arch of the radius of the cleaning cylinder, in combination with brushes so arranged as to keep the rollers clean, and the fan for removing the cotton from them as fast as ginned."

95. For an *Improvement in Head Rests for Chairs;* C. A. Mills, Dubuque, Iowa.

Claim.—"The semi-revolving and vertically adjustable supporting rod, said adjustment being effected by means of the spring, with its fork working into the notches of said support, or its equivalent."

96. For an *Improved Screw Machine;* John Moore, Madison, Indiana.

Claim.—"Operating the cutters in the die box, by means of the links, the internal and external plates, in connexion with the bar, the arc, the lever, and set bolts."

97. For an *Improvement in Ships' Capstans;* Charles Perley, City of New York.

Claim.—"Retaining said pinion in place by the overhanging base of the capstan barrel, except at the notches, at which point said pinion can be removed. 2d, Constructing the oil receptacle and groove (that contains the sustaining balls,) higher at the outside than the inside, to cause said balls in their motion to lubricate the journal."

98. For an *Improvement in Preparing Clay for Alum Making;* Henry D. Pochin, Salford, England; patented in England, January 30, 1855.

Claim.—"The calcining of china clay, or other aluminous minerals, with the carbonaceous substances, by which the alumina is brought into a condition to be easily acted upon by strong sulphuric and other acids, without adding thereto any substance injurious to the quality of the resulting compound, and the use of aluminous cake obtained in manufacturing the aluminous mordaunts used by calico printers and dyers, and in various other processes used by dyers, and in the preparation of white leather in the process termed tawing; also, in the manufacture of paper as a substitute for alum and the ordinary sulphate of alumina, as well as for the purpose of deodorizing and disinfecting decomposing animal or vegetable matters, and for the preparation of the ordinary sulphate of alumina and alums of commerce."

99. For an *Improvement in Cast Iron Railroad Car Wheels;* John M. Sigourney, Watertown, New York.

Claim.—"The formation of the hub of an iron wheel cast in one piece, viz: recessing the same by means of annular flanches bordering it inside, outside, or both in and outside, when combined with the single plate and braces."

100. For an *Improvement in Cotton Presses;* William F. and Charles J. Provost, Selma, Alabama.

Claim.—"So uniting of the follower nuts and levers, as that when the follower shall arrive at its highest point of elevation, it shall automatically swing out of the way of the filling box to facilitate the placing of the cotton or other material therein."

101. For a *Scale for Instrumental Music;* Abbey S. Smith, Rochester, New York.

Claim.—"An improvement of the established letter organization of the instrumental music scale, by originating and giving tangible form and shape to a character to be called and to denote sharp key A, and another flat key A, and another sharp key B, another flat key B, another sharp key C, and another flat key C, and the same of sharp and flat keys D, E, F, and G; for which characters I claim different specific forms or shapes, of each of the seven adopted musical letters, and different from the adopted shape of the adopted letters, all of which I arrange with other musical characters upon the staff, so that all retain their value, capacity, and position in perfect conformity to the organic law thereof, and the different keys in their definite capacity are in form brought to sight to be read at a glance of the eye by teacher and learner."

102. For an *Improvement in Nail Plate Feeding;* Perry A Wilbur, New Castle, Pa.; ante-dated, October 14, 1856.

Claim.—"Giving to the tubular nail plate feeder, its rising and falling semi-rotating, and forward and backward movements. Also, the lateral adjustability of the nail plate feeder to change the angle at which the nail plate approaches or passes under the cutting die, for the purpose of giving more or less head or point to the nail, whilst said feeder continues to receive its multiple motion."

103. For an *Improved Balance and Fastener for Window Sash;* Walter Worthen, Danville, New Hampshire.

Claim.—"Balancing and fastening window sash by one spring."

104. For an *Improvement in Filing and Setting Saws;* Horace R. Howlett, Assignor to self and A. W. Goodell, City of New York.

Claim.—"The file frame attached to the stock, in connexion with the gauge, guide, and lever, with saw set attached."

105. For a *Machine for Splitting Mackerel;* Sidney S. Turner, Lewiston, Maine, Assignor to self and Elmer Townsend, Boston, Massachusetts.

Claim.—"Combining with the cutting knife, and the movable carriage, a set of centering and holding jaws, or mechanical equivalent therefor. Also, the improvement of making the knife move faster than the carriage, or in other words, combining with the cutting knife and carriage, a mechanism for rotating the cutting or splitting part of the knife at a greater velocity than the carriage may be moved, the same being not only to facilitate the splitting of the fish, but to cause the discharge of it from the carriage.

Also, combining with the holding carriage, the centering jaws, and the splitting knife, a mechanism for operating or opening the centering jaws to allow of the discharge of the fish by the action of the knife. Also, combining with the holding carriage, its centering jaws, and the knife, a mechanism to open the said jaws during the backward movement of the carriage, the same being to prepare said jaws for the reception of a fish."

106. For an *Improvement in Lard Rendering Kettles;* John J. Bate, Brooklyn, N. Y.

Claim.—"The combination of the double steam kettle with the annular chamber, and covering the exterior of said chamber with a non-conductor."

107. For an *Improvement in Combined Table and Bedstead;* Charles Baum, Philadelphia, Pennsylvania.

Claim.—"The frame work composed of the upright posts, longitudinal bars, transverse bars, upper longitudinal bars, in combination with the board, rods, and frame."

108. For an *Improved Method of Bending Wood;* Thomas Blanchard, Boston, Mass.

Claim.—"1st, Subjecting the timber to pressure upon all sides, and continuing the same while it is being transferred from the straight trough to the curved mould. 2d The machine for bending timber, consisting essentially of the following elements, or their equivalents, in combination: 1st, The bending lever; 2d, the device for compressing the timber while it is being bent; 3d, the curved mould in which the pressure is continued, and in which the timber is removed from the machine after the bending operation is completed."

109. For an *Improvement in Washing Machines;* Albert A. Dailey, Wilson, N. Y.

Claim.—"The combination of the fluted cylinder, and concave, with the fluted cylinder."

110. For an *Improvement in Bottle Casters;* Edward Gleason, Dorchester, Mass.

Claim.—"The arrangement of the bottles centrally or thereabouts on or over the pivots of the niched or semi-cylindrical doors, when the latter are arranged for operation in relation to the body of the caster by the central rod or handle. Also, so gearing and connecting the revolving body of the caster with its separately turning doors, and arranging the same with its stationary base, that upon continuing to turn the central rod, after the doors have been opened or closed in the same direction which was required to open and close them, the whole body of the caster is made freely to turn on its base with the doors in the conditions they were set by said turning of the central rod or handle."

111. For an *Improvement in Making India Rubber Hose;* Jacob Henry Howell, Ansonia, Connecticut.

Claim.—"The method of constructing india rubber hose, that is to say, by winding a fillet spirally upon a mandrel, and upon this, winding a second that shall cover or break the line of joining of the first: the said fillets being made to adhere along their cut edges, as well as to each other."

112. For an *Improvement in Machines for Shearing Sheep;* J. V. Jenkins, Jackson, Michigan.

Claim.—"Operating the lever or plate by means of the eccentric upon the shaft, said shaft benig connected by a universal joint to the compensating shaft formed of the tube and rod, the rod being connected to the driving shaft by a universal joint."

113. For an *Improvement in Washing Machines;* James M. Kern, Morgantown, Virginia.

Claim.—"The hollow slotted face presser, in combination with the cloth covering thereof."

114. For an *Improvement in Processes for Silvering Mirrors;* Tony Petitjean, Tottenham Court Road, England.

Claim.—"The employment of tartaric acid with ammoniacal nitrate of silver, for the silvering of glass."

115. For an *Improvement in Rosin Soaps;* Augustus Pfaltz, Saxonville, Mass.

Claim.—"The mode of producing a solid soap from rosin, viz: by the use of an excess of soda or carbonate of soda, so as to form alkaline salts with the pinic and sylvic acids, which compounds are rendered nearly anhydrous."

116. For an *Improvement in Cooking Stoves;* Samuel Pierce, Troy, New York.

Claim.—"The flanches or slats. Also, the method of constructing the ash pit and lower oven bottom plate in one piece, with holes for the passage of air, for the purpose of communicating a greater degree of caloric to the air in the air chamber surrounding the oven. Also, the employment of the dumb flue lying within the upper fire flue, and forming part of this lower plate, and communicating with the elevated oven by a passage opening into its bottom."

117. For an *Improvement in the Process of Coating Metals with Metals;* Joseph Poleux, City of New York.

Claim.—"The employment of muriatic, nitric, or sulphuric acid of the ordinary degrees of concentration in commerce, viz: muriatic of 18° of Baume; nitric 38° do., and sulphuric 66° do., without diluting them, embracing the solution of spelter in the cleansing acid, and passing the cleansed articles directly into the metallic bath without any intermediate treatment whatever."

118. For an *Improvement in Capstans for Steamboats;* John Schaffer, Manchester, Pennsylvania.

Claim.—"The drum on the shaft of the capstan, as arranged, the capstan being steam driven by geared shafting connecting it with the 'little nigger,' and the whole being combined and made operative through the pulley."

119. For an *Improvement in Seed Planters;* Joseph H. Shireman, East Berlin, Pa.

Claim.—"The slide and clearers, in combination with the stirrer."

120. For an *Improvement in Stove Blacking;* William Thomas, Jr., Hingham, Mass.

Claim.—"The compound to be used for coating stoves and metallic surfaces, to impart to them a very durable polish, and to protect them more effectually from rust."

121. For an *Improvement in Devices for Putting up Caustic Alkalies;* George Thompson, East Tarentum, Pennsylvania.

Claim.—"The mode of protecting small packages of caustic soda or potash from the action of the atmosphere."

122. For an *Improvement in Washing Machines;* Charles N. Tyler, Assignor to Henry Pardin, Washington, D. C.

Claim.—"1st, Suspending the shaft to the cross beam, in such a manner as to be free to turn on its axis for the purpose of oscillating the disk to wash the clothes, and at the same time be capable of vibrating back and forth as the lever is raised or lowered, for the purpose of throwing the disk into or out of the tub. 2d, The sliding disk, in combination with the slotted shaft and adjustable spring."

123. For an *Improvement in Dyeing;* John P. Derby, Assignor to the Salisbury Manufacturing Co., Amesbury, Massachusetts.

Claim.—"The protecting of certain portions of the fabric from the action of the dye by a resinous compound, which may be applied cold, and afterwards removing the same by water, diluted alcohol, or the other means herein enumerated."

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124. For an *Improvement in Puppet Valve;* Robert P. Bradley, Cuyahoga Falls, Ohio.

Claim.—"1st, The construction of a puppet valve of the form of a cylinder of the full size of, or larger than the exterior of the face of the valve, with its face at the bottom, and with grooves in the sides. 2d, When the outlet of the valve chamber is at the side thereof. I claim forming a passage around the valve by making a groove around the interior of the chamber, and a similar groove around the exterior of the valve, to form a passage around the grooved cylindrical puppet valve, to form a passage of an area sufficient for the free escape of water at the outlet of the chamber."

125 For an *Improved Machine for Making Brass Kettles;* Edward C. Blakeslee, Enoch Platt, Jr., and Edmund Jordan, Waterbury, Connecticut.

Claim.—"The combination of the revolving female die, and its disk or rim, with the male die, when these are combined with the adjustable reducing rollers."

126. For an *Improvement in Locks;* William H. Butler, City of New York.

Claim—"Placing the case on an arbor or pin, which is secured in the jamb or casing of the door, the parts being arranged so that said case may be secured or locked on the arbor or pin, or allowed to be detached therefrom, without the aid of a key, whereby the device may be used as a lock or as a button."

127. For an *Improvement in Machines for Bending Sheet Metal;* George W. Burling, Trenton, New Jersey.

Claim.—"1st, The combination of the bars with the folding bar. 2d, The loose plates, in combination with the aforesaid bars."

128. For an *Improved Tooth Extractor;* Hazen J. Batchelder, West Fairlee, Vt.

Claim.—"The improved dental instrument, or combination of forceps, the latching mechanism, the supporting shank and handle."

129. For an *Improved Apparatus for Applying Freezing Mixtures to the Teeth;* Isaac B. Branch, Galena, Illinois.

Claim.—"The employment of instruments for applying cold as an anaethetic of the lip or lips. 2d, The combination with said instrument, or the application thereto, of the spiral spring and follower, or of their equivalent."

130. For an *Improved Arrangement of Buckets of Paddle Wheels;* Matthew A. Crooker, City of New York.

Claim.—"The improved method of arranging the buckets or floats of a paddle-wheel, when the buckets are to be broken into sections; that is to say, by arranging each set or section of buckets along four arcs which circumscribe the periphery, and which arcs are struck with a radius greater than the semi-diameter of the wheel; each set of buckets when placed upon the shaft being arranged so that the place where the arcs of the one set meet, shall stand opposite to the centre of an arc in the adjoining set, if the wheel be composed of but two sections, or when of more than two sections shall be divided proportionally."

131. For an *Improvement in Mould Candle Machines;* William C. Childs, Boston, Massachusetts.

Claim.—"Arranging the wick centering plate in the trough of the candle moulds, and on the bottom of said trough. Also, so applying the front board to the bottom board of the trough, that said front board may be turned down or removed from the trough, in order that the vertical edge or front part of the surplus fat in the trough may be exposed for the purpose of facilitating the removal of said surplus fat from the candles."

132. For an *Improved Method of Fastening Jewelry;* John B. Coppinger, City of New York.

Claim.—"The method of fastening jewelry, &c."

133. For an *Improved Current Wheel;* Plumer Chesley, Candia, New Hampshire.

Claim.—"1st, The regulators. 2d, The entire arrangement for starting and stopping the wheel."

134. For an *Improvement in Cooking Stoves;* John W. H. Doubler, Stephenson Co., Illinois.

Claim.—"The arrangement of the upper stationary doors set back, and lower set of doors, the latter being attached to the rising and falling grate, and hung and arranged so as to slide upwards, over, or against the upper doors when elevating the grate to raise or reduce the size of the fire, said lower sliding doors being provided with a damper or slide, whereby the same relative position of front draft opening to the fire is maintained, whatever the varied set in altitude of the sliding grate, and whereby, while a large amount of door surface is provided the furnace or stove, but a portion only of the weight of said doors has to be lifted in elevating the sliding grate."

135. For an *Improved Method of Preserving Dead Bodies;* John A. Gaussardia, Washington, District of Columbia.

Claim.—"Injecting the body with a mixture of arsenical pyroligneous acid, and then charging it with a current of electricity, and then filling the coffin in which the body is placed, and which is afterwards hermetically sealed with an alcoholic mixture of arsenic, together with the oils of cicuta, and caryophyllus aromaticus."

136. For an *Improved Gas Generator;* Charles A. Howard, Pontiac, Michigan.

Claim.—"The series of inclined retorts."

137. For an *Improvement in Seed Planters;* Jesse D. Havis, Perry, Georgia.

Claim.—"The vibrating hopper, in combination with the pin."

138. For an *Improvement in Evaporators for Salts;* John R. Hopkins, Auburn, N. Y.

Claim.—"The apparatus for the evaporation of solutions whose solvent capacities are increased by the application of heat, and diminished by cooling, consisting of a close boiler, in combination with one or more vats or reservoirs."

139. For an *Improvement in the Handles of Agricultural Forks, Shovels, and Hoes;* Reuben M. Hine, Throopsville, New York.

Claim.—"The improvement of making the handle of an agricultural fork, shovel, hoe, or equivalent implement, of a metallic tube filled with wood."

140. For an *Improved Water Wheel;* George E. W. Herbert, Cohocton, New York.

Claim.—"The flanches, in combination with the inclined position of the buckets."

141. For an *Improvement in Smut Machines;* Harvey B. Ingham, Camptown, Penna.

Claim.—"1st, The receptacle, arranged and operating in combination with the blast tubes and heating cylinder. 2d. The arrangement for discharging the grain by its centrifugal action, at an aperture on the upper side of the beating cylinder, and through a channel eccentrically around the blast pipe, whereby the grain is thrown into the blast higher in the pipe and is distributed more evenly therein."

142. For an *Improved Perch Coupling for Carriages;* Wm. S. Lord, Pulaski, Tenn.

Claim.—"Coupling the fore axle tree of a carriage or other vehicle, to the perch, by means of a cross-bar attached to the perch at a suitable distance in rear of the axle, in combination with connecting links."

143. For an *Improvement in Soap Mixtures;* George C. Lawrence, Winchester, Mass.

Claim.—"The combination of the soap compound with borax, in a pulverized or granular state."

144. For an *Improvement in Washing Machines;* Josiah Mumford and John W. Wilson, Clarksburg, Ohio.

Claim—"In combination with a rotating tub, having radial ribs on its bottom, a stationary rubbing board, also provided with radial ribs, and radial slots between them, through which any particular portions of the soiled clothes may be protruded to be washed, without washing the entire piece, which lies on top of said rubbing board."

145. For an *Improvement in Suspension Hook and Insect Insulator;* Joseph C. Moulton, Fitchburg, Massachusetts.

Claim.—"A new or improved article of manufacture, composed of a screw-rod, cup, and a hook."

146. For an *Improved Ivory Bleaching Apparatus;* John Phyfe, City of New York.

Claim.—"The bleaching of ivory by exposure to the rays of the sun on a glass table with a reflecter below it."

147. For an *Improvement in Stoves and Furnaces;* S. T. Savage, Albany, N. Y.

Claim.—"The use of the throat, aperture or passage surrounded by an air chamber, and pierced with numerous small holes through which atmospheric air passes in numerous small jets to the said throat, when the said throat is located between the fire chamber and a flue chamber leading to the exit pipe or chimney, and combined with a perforated plate interposed between the said throat and the fire."

148. For an *Improvement in Machines for Husking Corn;* Wm. H. Smith, Newport, Rhode Island.

Claim.—"The combination of the toothed disk wheel, elastic endless apron and brush cylinder, arranged and operating conjointly."

149. For an *Improvement in Oil Cans;* James M. Thompson, Holyoke, Massachusetts.

Claim.—"My improved arrangement of oil catching cup or recess, tube, chamber, tube, reservoir, and discharge tube."

150. For an *Improved Dumping Wagon;* Wm. B. Twiford, Horntown, Virginia.

Claim.—"The so hinging of the reach bars and the bed, to a bent axle, as that when said axle is allowed to turn in one direction in the hubs, the wagon body shall dump, and when turned in the opposite direction, be raised up horizontally, without one part being disconnected to slide or run on the other part."

151. For an *Improved Mode of Securing Sheet Metal Coverings for Roofs;* Wm. H. Trissler and John Stewart, Fairview, Pennsylvania.

Claim.—"The double lapping joint for uniting the sheets of metal without solder. Also, the combination of the scroll and wing edges, for uniting the strips of covering."

152. For an *Improvement in Washing Machines;* Moses D. Wells, Morgantown, Va.

Claim.—"The reciprocating clothes rack, in combination with the wings."

153. For an *Improvement in Breech Loading Fire Arms;* Thornton A. Washington, U. S. Army.

Claim.—"The revolving cylinder breech, having the funnel passage, and the interior flanched cylinder, in combination with the chamber and breech seat."

154. For an *Improvement in Shaft Tugs;* Wm. Wentz, Geneva, New York.

Claim.—"The new manufacture of shaft tug described, viz: a metal shaft tug, provided with a buckle for the back strap, and a loop for the trace, either with or without a loop for the belly band."

155. For an *Improvement in Metallic Pens;* John Wilcox, Philadelphia, Penn.

Claim.—"The double pointed pen, in combination with the flanched swivel plate and slide piece."

156. For an *Improved Back Band Hook for Plough Harness;* Noah Warlick, Chambers County, Alabama.

Claim.—"The reverse hook, in combination with the guard enclosing the same."

157. For an *Improvement in Breech Loading Fire Arms;* George W. Morse, Baton Rouge, Louisiana.

Claim.—"Inserting the rim, or its equivalent, without contact, into the chamber—contact being attained through the medium of a cartridge case. Also, the nippers and the mode of operating them by the pins, and the shoulders on the hammer, or equivalents therefor. Also, the combination of movable parts, or their equivalents, whereby I retract or deliver the gun of a cartridge, drop it, open and clear the way for the insertion of another cartridge, whether the previous charge was fired or failed to fire, and cock the hammer automatically at one motion."

158. For an *Improvement in Cartridges;* George W. Morse, Baton Rouge, La.

Claim.—"The combination and arrangement of the cartridge case as constructed, with the priming apparatus as constructed, or their equivalents, whereby I effect the entire exclusion of any and all escape of the gas produced by the combustion of the powder of the cartridge and priming, except by the one channel, the bore of the barrel of the gun—the breech joints and priming vent being thereby so effectually sealed and closed that no air can escape at these parts of the gun after the charge is fired, until the cartridge case is withdrawn from the bore, although air blown in at the muzzle before firing the charge might escape through these joints, as it would in the case above referred to."

159. For an *Improvement in Railroad Car Coupling;* D. Lynahon and Charles J. Wing, Assignors to D. Lynahon, Buffalo, New York.

Claim.—"The construction of the coupling, viz: having the cross-bars, with pins attached, and encompassed by springs, the bars and springs being placed in the boxes, and the shackles formed with inclined planes at their ends."

160. For an *Improvement in Working Over Vulcanized India Rubber;* Henry Forstrick, Hoboken, New Jersey.

Claim.—"The manner of extracting inorganic matter from vulcanized india rubber, gutta percha, and other gums, or their compounds, by the application of diluted nitric acid, and the use of fusel oil (grain oil,) either in a heated state mixed with the gum, or in the shape of vapors for the restoration of the cleansed gums to the state of cohesion."

161. For an *Improved Projectile for Ordnance;* John B. Read, Tuscaloosa, Alabama.

Claim.—"The attachment to elongated shot or shells of a cylinder of wrought iron fastened to the body of the shot or shell, by having its bottom or sides more or less embedded in the cast metal of which the shot may be composed; the cylinder to be attached to the but of the shot or shell, and its sides to project beyond, being thinned down after a short bevel, to such a degree as exactly to fit the bore of the gun, when the charge is fired, so as to save windage in all cases, and impart rotation when rifle grooves are employed."

162. For an *Improvement in Billiard Table Cushions;* William B. Carpenter, Brooklyn, New York.

Claim.—"The mode of the fastening of the metallic spring strip or facing, firmly at or near its entire lower edge."

RE-ISSUES FOR OCTOBER, 1856.

1. For an *Improvement in Furnaces for Burning Wet Fuel;* Moses Thompson, New Orleans, Louisiana; patented April 10, 1855; re-issued October 7, 1856.

Claim.—"The combustion, for the purposes of a high or very wet and green wood, by the employment of a series of fire chambers, to communicate with one common flue or mixing chamber, when any number of said chambers are nearly closed to the admission of air when charged, whilst the remaining chamber or chambers are in full communication with the flue, and has a free supply of air admitted, and the ash-pit of each chamber in its turn is nearly closed and then opened, and has air admitted, whereby the heat required is rendered continuous and comparatively uniform, while the fuel in some of the chambers is being heated and decomposed to a desirable degree."

2. For an *Improvement in the Buff for Polishing Spoons and other Articles;* Luther Boardman, East Haddam, Connecticut; patented December 15, 1843; re-issued October 7, 1856.

Claim.—"A cylindrical buff composed of soft leather disks or rings, when the outer portions of said disks are left perfectly free from each other, so as to admit of the yielding necessary to their proper action."

3. For an *Improvement in Manufacturing Hat Bodies;* Charles St. John, Henry A. Burr, Albert H. Wright and James M. Ribbet, Assignees of Henry A. Wells, dec'd., City of New York; patented April 25, 1846; re-issued October 7, 1856.

Claim.—"The forming of the bat of fur fibres on a perforated cone or other form, in combination with the hardening of such bat, while on such cone or other form, to give it the required consistency to admit of taking it off in a suitable condition for sizing by the well known process of felting."

4. For an *Improvement in Door Locks;* John P, Sherwood. Assignor to Calvin Adams, Fort Edward, New York, and re-issued to said Sherwood; patented December 17, 1842; re-issued to said Adams, May 13, 1851; re-issued to said Sherwood, October 7, 1856.

Claim.—"Making the cases of door locks and latches double faced, or so furnished that either side may be used for the outside, in order that the same lock or case fastening may answer for a right or left hand door. Also, the peculiar construction and double action (upon an inclined and horizontal track or way) of the locking and safety cars with one another, and with the connecting or vibrating bar and bolt, so as to fasten the bolt securely, and prevent its being picked. Also, so constructing the bolt, that by simple turning it over in the lock case, it is adapted to a right or left-hand door."

5. For an *Improvement in Artificial Stone;* St. Julien Ravenel, Charleston, South Carolina; patented August 12, 1856; re-issued October 14, 1856.

Claim.—"The composition of marl and slacked lime, substantially in the proportions for producing an artificial stone, or a substitute for stone and bricks."

6. For an *Improvement in Self-sealing Cans;* Robert Arthur, Philadelphia, Penna.; patented January 2, 1855; re-issued June 10, 1856; re-re-issued October 14, 1856.

Claim.—"1st, For a vessel made with a groove to surround its mouth, prepared with cement, and ready for hermetically sealing itself, I make no claim; but, 2d, I claim the employment of elastic packing, arranged and retained by a groove of an acute form, or whose sides are in close proximity."

7. For an *Improved Boring Machine;* Arcalous Wyckoff, Assignee of Wyckoff & Morrison, Elmira, New York; patented September 23, 1855; re-issued Oct. 14, 1856.

Claim.—"1st, The tubular or hollow auger or bits as constructed, having the cutting lips of the bits approach the centre, and yet separated from each other, doing without the use of a screw on the end of the bit, for the purpose of preventing the bit from following the grain of the wood. 2d, The worm, operating on its own axle, and independent of the revolutions of the auger or bits, for the purpose of cleaning away the chips."

8. For an *Improved Piano-Forte Action;* Daniel H. Shirley, Boston, Massachusetts; patented November 28, 1854; re-issued October 21, 1856.

Claim.—"The peculiar manner in which the back catch and the lifter, or its equivalent, are combined together, and with the key-lever, viz: by a lever hinged to the key-lever, and fastened to both back catch and lifter."

9. For an *Improvement in Reversible Horse Power;* Philip H. Kells, Hudson, N. Y.; patented July 8, 1856; re-issued October 28, 1856.

Claim.—"Constructing the horse power so that the converge gear may be shifted to, and secured upon, either end of the main shaft, so that by reversing the pulley and pinion with their shaft, and placing their converge gear upon the proper end of the main shaft, the machine may be converted from a right to a left-hand one, or vice versa, without removing the main shaft."

10. For an *Improved Apparatus for Heating by Gas;* Wm. F. Shaw, Boston, Mass.; patented February 26, 1856; re-issued October 28, 1856.

Claim.—"The combination and arrangement of air and gas burners, or distributors, chambers, and their flue and air supply conductors, in combination with the gas burner, the perforated or wire gauze tube."

11. For an *Improvement in Harness Saddles;* O. B. North & Co., New Britain, Connecticut, Assignees (through immediate assignment) of A. H. Gazlay, deceased.

Claim.—"The manner of constructing harness saddles, in making the jockey skirts and saddle of metal cast in one piece."

DESIGNS FOR OCTOBER, 1856.

1. For *Parlor Cooking Stoves;* Daniel Wilson, Nashua, New Hampshire; Oct. 7, 1856.

Claim.—"The design, configuration, and arrangement in bas-relief on the ends and front of the stove."

2. For *Cylindrical Coal Stove;* Russel Wheeler and Stephen A. Bailey, Utica, New York; October 7, 1856.

Claim.—"The general design and configuration of the stove."

3. For *Cooking Stoves;* Hudson E. Bridge, St. Louis, Missouri; October 7, 1856.

Claim.—"The ornamental configuration, composing a design for a cooking stove."

4. For *Busts of J. C. Fremont;* John Gott, Albany, New York; October 7, 1856.

Claim.—"The new and original design of a bust of Col. John C. Fremont."

5. For *Stoves;* N. S. Vedder and Wm. L. Sanderson, Troy, N. Y., Assignors to North, Chase & North, Philadelphia, Penna.; October 7, 1856.

Claim.—"The design and configuration of the ornamental plates, forming an ornamental design for stoves."

6. For *Stoves;* S. W Gibbs, Albany, N. Y., Assignor to North, Chase & North, Philadelphia, Penna.; October 7, 1856.

Claim.—"The design and configuration of the ornaments forming an ornamental design for stoves."

7. For *Parlor Stoves;* Jacob Beesley and Edward J. Delany, Assignors to Cresson, Stuart & Peterson, Philadelphia, Penna.; October 7, 1856.

Claim.—"The design for parlor stoves."

8. For *Cooking Stoves;* N. S. Vedder, Assignor to Graff, Resinger & Graff, Troy, New York; October 7, 1856.

Claim.—"The use of the patterns or devices for ornamenting the side pieces, front and back pieces of cooking stoves."

9. For *Cooking Stove Plates;* N. S. Vedder, Assignor to Mann, Torrance & Co., Troy, New York; October 7, 1856.

Claim.—"The ornamental design for panels of plates of cooking stoves."

10. For *Stoves;* Garrettson Smith, Henry Brown, and Joseph A. Read, Assignors to Hayward, Bartlett & Co., Philadelphia, Penna.; October 7, 1856.

Claim.—"The design, configuration, and arrangement of the ornaments in bas-relief and moulding, constituting an ornamental stove design."

11. For *Stoves;* Hudson E. Bridge, St. Louis, Missouri; October 14, 1856.

Claim.—"The configuration composing an ornamental design for the top, base, and door of a sheet iron air tight stove."

12. For *Cook Stoves;* N. S. Vedder and Wm. L. Sanderson, Troy, Assignors to G. W. Eddy, Watertown, New York; October 21, 1856.

Claim.—"The ornamental design and configuration of cook stove plates."

13. For *Statues of Burton as Captain Cuttle;* Charles Muller, City of New York; October 21, 1856.

Claim—"For a statue of Mr. Burton as Captain Cuttle."

MECHANICS, PHYSICS, AND CHEMISTRY.

*The Gums and Resins of Commerce.** By P. L. Simmonds.

The Elastic Gums are among the most important and generally useful that come into commerce, and although at present confined to two varieties, there is no reason why additions should not be made to the list, and investigation promoted to elicit the comparative value of others. The rapid progress of the submarine telegraph, setting aside other important commercial uses of gutta percha, loudly calls for fresh supplies. If no other purpose had been subserved by this Indian gum than that of encasing the telegraph wires, mankind would have reason to be eminently grateful to the discoverers, and to the Society of Arts for the reward and publicity given to its merits.

We can all recollect when the only uses to which india-rubber was applied, was to rub out pencil marks, and make trap-balls for boys, but now it is made into shoes and hats, caps and cloaks, foot-balls and purses, ribbons and cushions, boats, beds, tents, and bags; into pontoons for pushing armies across rivers, and into camels for lifting ships over shoals. It is also applied to a variety of other uses and purposes, the mere enumeration of which would be tedious. New applications of it are indeed continually being made.

Boundless forests of the Serang tree are found upon the banks of the Amazon, and the exportation of this elastic gum from the mouth of that river is daily becoming a business of more and more value, extent, and importance.

Already within the past five years we have doubled our imports from Brazil (besides the large quantities which the United States draw from thence), and we have also increased our supplies of this elastic gum from the East, the imports from Singapore having risen from 559 cwt. in 1849, to 3030 cwt. in 1853.

Of substances which may be used as substitutes to some extent for caoutchouc or gutta percha, the inspissated juices of the jack fruits and trees, those from the wild and cultivated bread fruit trees, and the lola tree may be mentioned.

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*From the Journal of the Society of Arts, Lond., November, 1855.

Various species of Indian fig-trees, as *Ficus Radula*, *elliptica*, &c., also furnish portions of the elastic gum of commerce. *Vahea gummifera* likewise supplies caoutchouc. The *Urceola elastica* (which produces the Gintawan of the Malays,) abounds on the islands of the Indian Archipelago ; in Java it is called " bendud."

The concrete milky juice of the *Cryptostigeia grandiflora*—a handsome climber, common in the Madras Peninsula—has long been known to contain caoutchouc, but it has not yet been collected for the purposes of commerce, and it is doubtful if a sufficient quantity could be obtained to render it an article of trade. The milk from the cow tree appears to contain caoutchouc. It is supposed to be obtained from *Tabernæmontana utilis* of Arnot, or a species of *Brosimum*. On the river Demarara the Indians climb the rubber tree, tap the trunk, and as the gum exudes, rub it on their bodies till it assumes a sufficient consistency to be formed into balls.

Recent inquiry has shown that caoutchouc is furnished of good quality, by a large number of milky-juiced plants belonging to different families (*Sapotacea*, *Apocynaceæ*, and *Euphorbiaceæ*). In the East, Assam now furnishes large quantities of india rubber from *Ficus elastica*. Complaints are, however, made of the want of care in the preparation of the article from Assam.

If the previous purifying of the gum be properly attended to—and in this process the whole art of manufacturing the perfectly elastic gum of commerce seems to exist—the gum should not, by any exposure to the atmosphere, be subject to the least degree of clamminess or viscidity ; and if this important point be not fully attained, the article is of no use in the manufacture of those fine elastic threads which constitute its chief value in the European markets. The art of obtaining this complete freedom from clamminess, and consequent perfect elasticity, does not appear by any means to have been reduced to a certainty ; and, consequently, a far better acquaintance with the article than is yet possessed by the Assam manufacturers seems requisite before it can be obtained with constantly the same results.

A substance resembling caoutchouc was said to have been obtained in Sierra Leone from a plant of the Euphorbia tribe, so long ago as Tuckey's voyage up the Congo, in 1816. Some large forest trees, belonging to the Sapotaceæ family, which abound at the foot of the Ghauts, N. E. of Trevandrum, furnish a valuable elastic gum, called by the Malays panchonthee, which bears a strong resemblance to gutta percha both in external appearance and mechanical properties, and the real *Isonandra gutta*, would appear to be common in the forests of the Neilgherries.

Gutta Percha has been discovered in the British province of Mergui, and though not precisely identical with the gutta percha of commerce, it possesses all the valuable properties of that substance, including plasticity in hot water, and the power of insulating electric currents.

The tree from which the true gutta taban is produced (erroneously misnamed in Europe gutta percha, a gum yielded by a different tree), is one of the most common in the jungles of Johore and the Malay Peninsula. It is not found in the alluvial districts, but in undulating or hilly ground. There is a great uniformity in the size of the full grown tabans, which rise with perfectly straight trunks from 60 to 80 feet in height, and from 2 to 3 feet in diameter, the branches being few and small. The natives, after felling the tree, make an incision round it, from which the milk flows. This is repeated at distances of 6 to 18 inches along the whole trunk. It appears that the taban, or milky juice, will not flow freely like dammer and caoutchouc, but rapidly concretes. Its appearance in this state before being boiled is very different from that of the article as imported into Singapore, and thence shipped to Europe. It has a dry, ragged look, resembling shreds of bark, and instead of being dense and tough, is light, and possesses so little cohesion that it is easily torn in pieces.

Various statements are made as to the produce of each tree, which is somewhat surprising, considering the uniform size of the trees. The extremes mentioned are two catties and fifty catties. Dr. Oxley takes the average yield at ten catties, but probably five would be nearer the mark, hence it would take twenty trees to produce one picul of gutta, or 133 lbs., and as the exports of gutta percha, from the commencement of the trade up to the close of 1853, have amounted to 3107 tons, it follows that upwards of one million trees must have been destroyed to obtain that quantity in nine years. The natives, however, do not appear to be under any apprehension that the trees will be extirpated, and smile at the probability when suggested, for it is only trees arrived at their full growth, or at least at a very considerable age, that repay the labor of felling them and extracting the gutta, and those of all inferior ages which are therefore left untouched, will, it is supposed, keep up the race.

The collection of the gutta has widely extended, embracing now the Johore Archipelago, Sumatra, Borneo, and Java. Unfortunately, the quality has deteriorated by the admixture of gutta percha, jelotong, gegrek, litchin, and other inferior gums, the products of different trees, which are often used to adulterate the taban.

The Gitah Lahoe is the produce of *Ficus cerifera*, Blume, which promises to be of great importance in an industrial point of view. The natives of Sumatra form torches of it, which burn with a clear flame, but make a great deal of smoke. A hydro-carbon, closely resembling Cullemundoo gum, from Jaulhna, was shown this year at Madras, obtained from *Euphorbia tirucalli.* It differs considerably from caoutchouc or gutta percha in its physical qualities.

The milky juice of the Muddar plant of India (the *Asclepias* or *Calotropus gigantea*), gradually dries and becomes tough and hard. like gutta percha. It thrives on the poorest soils, and also furnishes an excellent fibre, useful in the place of hemp and flax.

The juice of the sappodilla plum tree, the *Achras sapota* of the West Indies and South America, is slightly adhesive to the touch, but it differs from gutta percha by becoming adhesive and extremely glutinous after being immersed in boiling water, while gutta percha immediately on exposure to a cooler temperature regains its original toughness and flexibility.

An elastic gum resin from an Australian Ficus was shown at Paris in the New South Wales collection, in small tears, of a dingy appearance, which might prove useful. A large portion dissolves in warm linseed oil, but spirits of wine does not act readily on it. By mastication it becomes tenaceous and bleaches thoroughly.

The Royal Patriotic Society of Havana endeavored to introduce the cultivation of the *Ficus elastica*, and other elastic gum-yielding plants, into the Island of Cuba, but their efforts seem not to have succeeded.

The Cullemundoo gum attracted particular attention in 1851, and the exhibitor was rewarded with a prize medal, from the impression of its adaptability to various purposes in the arts. It is obtained from the *Euphorbia antiquorum* of Roxburgh, and this year, at the local exhibition at Madras, the products of two other species, *E. Tirucalli* and *neurifolia*, received honorable notice, although the substances differed in their physical qualities from the true elastic gums of commerce.

An examination of the inspissated gum elastic juices of a number of trees from different localities, and prepared in a different manner, renders it probable that there are a variety of similar vegetable products yet untried, which may be advantageously introduced into commerce. They certainly deserve to be brought specially under the notice of our manufacturers, though as yet many of them are almost unknown to the very natives of the places where they are prepared. Gutta trap, the inspissated sap of an Artocarpus, obtained on the Island of Singapore, and used for making birdlime, was favorably mentioned by the Jurors in 1851.

A few words on the medicinal gums of commerce will serve to bring this lengthy paper to a close.

Gum Ammoniacum.—An opaque cream-colored gum, closely resembling in taste, smell, and general appearance, the ammoniacum of the shops, was gathered by the late Dr. Stocks, in Beloochistan, from the *Dorema aureur*, a tall, umbeliferous plant, described by him in Hooker's *Journal of Botany*, vol. iv, p. 149. He also found there the following fœtid gums, differing from the ordinary ones of English commerce. Gum resin of *Ferula orientalis*, Linn., in semi-transparent, yellowish-brown tears, having a galbanum-like smell, and a strong, bitter, peculiar taste. From another species of Ferula he gathered a pale, yellow, waxy-looking, gum resin, with a somewhat alliaceous and cubeb-like taste. The average imports of ammoniacum in the last few years have been about 400 cwts. Medicinally it is considered the least powerful of the fœtid gum resins.

Euphorbia officinarum, *canariensis*, and some other fleshy species, produce the saline, waxy resin, called in the druggists' shops, gum euphorbium, which is the inspissated milky juice of the plant.

Asafœtida (*Narthex asafœtida*), according to the information of Dr. Falconer, who gathered it in among the Dardohs, a wild race of Central Asia, furnishes the Heeng, or asafœtida of commerce.

The plant is found in the greatest abundance in the Persian provinces of Khorhassan and Laar, and thence extends on the one hand into the plains of Toorkistan, upon the Oxus, where it seems to have been met with by Sir Alexander Burnes, and on the other, stretches across from Beloochistan, through Candahar and other provinces of Affghanistan, to the eastern side of the valley of the Indus in Astore. Dr. Falconer did not meet with it in Cashmere. Captain Burslem, in his Journey in Toorkistan, states that the asafœtida shrub abounded on the hills, and they were almost overpowered by the horrible stench exhaled therefrom. It is collected in its wild state and sent to Cabul and India, yielding a good profit to those who pick it, as it is used very generally throughout the East for kabobs and curries.

Although these fœtid gums are now branded with all sorts of vile names for their offensive odor, yet they were in high repute among the ancients, asafœtida being reckoned one of the most agreeable seasonings for food, and highly esteemed for its medicinal uses, so that it was worth its weight in silver. A stalk of the plant was sent to the Emperor Nero, and yearly to Apollo of Delphos, as more precious than the other productions of the earth, inasmuch, that "he is worthy of silphium," passed into a proverb, (silphium being one of the names by which it was formerly known.) Even in the present day, the Persians and other Asiatics flavor their food with asafœtida, and term it the food of the gods. Tastes we know differ, for by some garlic is highly esteemed, while others detest its flavor. Asafœtida ranks high in the Materia Medica of the Chinese physicians. It forms an important article of trade in the East. The vessels that carry it to the Chinese ports from Bombay, are so imbued with the odor, that they spoil most other goods. Our annual imports of asafœtida range from 50 to 100 tons, but the greater portion is re-exported.

The gum resin called SARCOCOL is seldom now seen in the shops. It has the translucency and much the appearance of gum arabic. In Persia it exudes from all the parts of the *Penœa mucronata*, and in the Cape Colony it is said to be produced on the perianth of *P. Sarcocolla*, and other species of the shrub.

GAMBOGE.—This gum resin is imported to the extent of from 500 to 1000 cwt. annually, and is used in water color painting, and in medicine as a well-known cathartic. Our principal supplies are received from Singapore. Gamboge of good quality was worth there early in the year, 26 dollars the picul, equal to about £4 4s. the cwt. It may be obtained also from Ceylon, where it is produced by the *Hebradendron cambogoides*. The plants furnishing gamboge in other districts are not yet well defined.

Gamboge is obtained in Coorg, Mysore, Canara, Malacca, and Labuan. That from Malacca is the finest pipe variety; all the others are in the form of lumps or tears. The commercial character of this product may be altered by trivial circumstances, the exudation being yellow, reddish, or brown, and of different degrees of solidity, according to the season of the year and the method of manipulation.

The gamboge of the Madras peninsula has been found to be a useful pigment and an effective purgative. It has been lately added to the list of country medicines, and it appears that the tree is so abundant along the coast of the Ghauts, that the product may be obtained in very considerable quantities in the forests of Mysore, Malabar, and Canara. It has been collected there with much care in homogeneous masses, without air vessels, free of woody fibres or other impurities, and is produced by *Garcinia pictoria*, while that from Labuan is probably from *G. Cochin-Chinensis*.

Opium.—This well-known gum, the produce of the capsule of the poppy, enters largely into commerce in the East for stimulating and exciting purposes, and in Europe for medicine. The production in Bengal, chiefly for the supply of China, amounts to between five and six millions a year! Our imports average from 150,000 to 200,000 lbs., and the home consumption has exceeded 60,000 lbs. per annum, on the average of the last four years.

Gum Scammony is the milky juice, or gummy resinous exudation of a plant of the Convolvulus tribe, which is used entirely in medicine, and it is exceedingly difficult to get it genuine. The consumption is not large; the imports in 1853 were 9704 lbs., nearly all from the Turkish dominions.

There are one or two important articles of commerce, which, though not strictly gums or resins, but more properly inspissated extracts, deserve a passing notice; these are the Kinos imported for manufacturing and medicinal use. The Society of Arts early stimulated inquiry and investigation into these products, for the use of the tanner, dyer, &c., and in 1804 the gold medal was awarded to Dr. Howison, for certain useful extracts, and in 1824 Messrs. Pitchey and Wood, of Van Diemens Land, also received the Society's Ceres Medal for other extracts. Sir Joseph Banks had some time previously drawn attention to the value of Terra Japonica, or Gambier. This is an extract prepared from the leaves and branches of the *Uncaria Gambier*, of Roxburgh, cultivated chiefly at Singapore, by the Chinese, and of which our imports average upwards of 91,000 cwt. per annum.

The Cutch of commerce, kuth, or catechu of India, is manufactured in the East from the heart and leaves of the wood of *Acacia Catechu*. Our imports of this substance for tanning, &c., amount to about 35,000 cwt. annually. The sources of supply are Burmah, Bombay, the Concan, and other parts of India. Of this astringent there are now large exports from the Madras territories. Last year (1854) they amounted to 1369 cwts.

There are many samples from Madras, which may be reduced to three varieties:—

1. Circular flat cakes from Travancore, covered on both sides with paddy (rice) husks.
2. Large flat cakes, from the northern division, varying in color from brick-dust to dark-yellow.
3. Round balls of a dark-brown color, the size of a small orange, from Mangalore, where a large manufacture takes place. The exports of Cutch from Calcutta in the last two years have been as follows:—

	1855.	1854.
To Great Britain,	26,624	27,084
France,	8,712	2,812
North America,	2,201	10,007
Indian Maunds,	37,537	39,903

Gambier from Rangoon comes in cubical cakes, covered with a malvaceous leaf.

The genuine Gum Kino of commerce is, as I have already stated, the natural exudation of *Pterocarpus marsupium*, and forms an article of export to the extent of a few tons from the Malabar coast. Gum butea, from *Butea frondosa*, furnishes the Bengal kino nearly equal to the preceding.

The specimens I have seen are quite identical with the ordinary kino of commerce. Australian kino is obtained from the iron bark tree, a species of Eucalyptus. Jamaica kino from the *Cocoloba uvifera.*

Annual Imports and Estimated Value of the Gums, Resins, Balsams, &c., of British Commerce, including Gum substitutes and Vegetable Extracts:—

Balsams, about	1,000 casks or packages,		£ 14,000
Liquorice Paste,	2,089 cwts.		
" Juice,	9,775 "		
Turpentine,	17,038 tons,		170,380
Tar,	24,500 "	at £6,	147,000
Pitch and Petroleum,	6,353 cwts.	at 50s. per ton	800
Rosin,	23,000 tons,		115,000
British Gum,	3,000 tons	at £42,	110,040
Lac-dye,	18,050 cwts.	at £11,	198,550
Seed-Lac,	402 "	25s.,	503
Shellac,	28,512 "	50s.,	71,280
Stick-Lac,	3,000 "	30s.,	4,500
Caoutchouc,	27,588 "	£7	193,116
Gutta Percha,	21,792 "	£5 10s.,	119,856
Terra Japonica, or Gambier,	4,550 tons	at £25,	113,750
Cutch,	1,700 "	£30,	51,000
Aloes,	110 "	£60,	6,600
Amber,	37 cwt.		
Ammoniac,	28 cwts.	at £2,	56
Anime and Copal,	6,000 cwts.	at 16s.	96,000
Arabic,	61,614 "	50s.,	153,535
Asafœtida,	400 "	30s.,	600
Benjamin,	900 "	£12,	10,800
Dammer,	1,300 "	50s.,	3,250
Dragon's Blood,	190 "	£6,	1,140
Galbunum,	24 "	£11,	264
Gamboge,	341 "	£5,	1,705
Guiacum,	20 "	£7,	140
Kino,	250 "	£2,	500
Mastic,	430 "	£22 10s.,	10,125
Myrrh,	230 "	£3,	690
Opium,	159,312 lbs.	at 10s.,	79,656
Olibanum,	10,000 cwts.	at £2,	20,000
Sandarac,	230 "	70s.,	805
Scammony,	9,704 lbs.	at £2,.	19,408
Senegal,	9,000 cwts.	at 45s.,	20,250
Tragacanth,	70 tons	at £5,	350
Unenumerated Gums,	6,000 cwts.	at £2,	12,000

The aggregate market value of these articles, therefore, at the current prices of the day, approximates to two millions sterling.

For the Journal of the Franklin Institute.

Improvement in Drills for Boring Rocks, &c. By John Thomson.

To the Committee on Publications.

Please publish in your valuable *Journal*, one very important and useful purpose to which *fusible metal* may be put with great advantage; that is, to the making of drills for boring rock, more especially in sinking artesian wells.

This new drill I have proved. It consists of an iron cup, with a stem to fit into the other machinery, as the common drill at present does. Into this cup, a suitable number of hard tempered steel chisels are set, and the whole run into one solid tool, by means of the fusible metal; the chisels being spread beyond the edge of the cup, so as to bore any required width of bore hole, and to allow the free passage of water and debris while working.

There is no difficulty in the manufacture of this tool, nor is there any danger of injuring the temper of the steel chisels, as 208 degrees is the melting point of this metal, which is hence quite fluid with boiling water. When finished it will be found solid and strong as if done with melted lead. Modifications of the cup, and also of the chisels, are to be expected, but the idea is here fully advanced, and the advantages of this arrangement of tool I would enumerate. 1st, This drill when reduced in size, or blunted by boring, can be easily heated so as to melt the fusible metal, when the chisels may all be lifted out separately and sharpened; after which they may be set out to the original gauge in the cup of metal, and when cold, the tool is as good as at first (without the aid of a blacksmith). 2d, By using this drill, (having so many cutters,) the hole will always be kept quite circular; the present system often (getting oval and) cornering, and causing a sticking of the tool while working, not easily remedied at all times. 3d, Any size of hole may be bored with this instrument, from the smallest to one of as many feet in diameter as of inches with the present drills, requiring only an increased size of cup, and an indefinite number of chisels as cutters, with, of course, an extra power to work it. This is a very important advantage over the present system of drill boring, and applicable to quarries, and heavy cuttings generally. 4th, In boring very large holes, this drill can never be affected when encountering fissures, inclined strata of variable hardness, nodules, &c. in the rock, so as to drive or lead it off the straight, the area of its face being so large, extending over and embracing the difficulties within its extent, which might prove failures in small deep bearings. No large hole has ever been or can be drilled in hard rock with the present tools, but with this improved drill it can; as it may be worked either horizontally, or in any inclined position, with the same facility as those in present use. I would recommend their immediate adoption, of whatever size. There is work enough ahead in this country for improved drills, for, in addition to boring the earth in search of water or for minerals, we have the prospect of cutting and boring through mountains for railroads and canals, and the rocky barrier in Central America, that separates the Atlantic and Pacific Oceans, must be demolished, before we stop our onward course of improvement; and these things I hope to see accomplished, aided by this improved drill, the use of which admits of plenty of gunpowder being used in blasting, which at present is so limited, on account of the small sized drill, which has been the only boring instrument in use from time immemorial.

In confirmation, and in conclusion, I hold myself in readiness, upon a proper call, to prove to the fullest my invention, which is here so briefly, but I trust intelligibly described.

Fusible metal is a composition of 8 parts bismuth, 5 parts lead, and 3 parts tin.

Philadelphia, Nov. 14, 1856.

*On the Compounds of Carbon and Iron, and their Influence on the Production of Pig Iron.** By A. GURLT.

(Continued from p. 341.)

After these remarks it will be as well to consider the somewhat modified theory of the production of cast iron, and to follow a charge from the furnace mouth to the crucible. The charge gradually descending as the furnace becomes heated, arrives at the zone of reduction with a temperature of about 400° C. (750° F.) Here the oxides of iron, manganese, sulphur, and phosphorus are gradually reduced, the electro-negative substances combining the moment they are set free with the electro-positive to form metallic sulphites and phosphurets. After the reduction of all the oxides is effected, which is completed about the junction of the belly with the boshes, the charge, now consisting of metal, phosphurets, and sulphurets, with the materials of the slag, enters the zone of carburation, and comes in contact with a large excess of carbonizing gases, viz: oxide of carbon and cyanogen. By its intimate contact with these carbonizing gases and the carbon of the fuel at the high temperature here existing, the reguline metal existing in the state of soft malleable iron uncombined with any electro-negative body becomes carbonized, that is to say, it unites chemically with carbon, which it abstracts from the carbonic oxide and cyanogen gases proportionately as it sinks deeper in the boshes. In most blast furnaces, however, the boshes are considerably contracted at the base, so that the charge is detained, relatively speaking, sufficiently long in this region to combine with its maximum of carbon, passing into the condition of tetracarburet. In the normal working of the furnace then there is always one portion of the iron saturated with carbon when it enters the zone of fusion. In the zone of fusion the pig iron and the earthy matters are melted, and sink together through the hottest part of the furnace, the zone of oxidation, into the crucible, where it collects. If now the temperature existing in the zones of fusion and oxidation were not much higher than the point of fusion of the specular iron, the tetracarburet found in the zone of carburation would arrive undecomposed, and solidify after tapping as white cast iron, with little or no graphite. If the charge remained long enough in the zone of carburation to saturate the whole of the iron with carbon, specular iron would be produced. In either case, however, the whole of the carbon exists chemically combined with the iron, with the occasional exception of that small quantity of graphite separated by silicium which is not visible on the fracture. The reduction of the silicium seems to commence about the melting-point of specular iron as it exists in very small quantity in this kind of iron, and in white cast iron produced from easily fusible ores at a low temperature; in gray cast iron, however, which is known to require a much higher temperature and more refractory ores, it exists in much larger quantity. The very considerable difference of temperature which must prevail in the furnace during the preparation of white and gray cast iron, may be judged of from the fact, that with the same ores and fuel the quantity of carbon required to produce gray cast iron will be 50 per cent. greater than is necessary for white cast iron. When, therefore, the temperature of the zones of fusion and oxidation considerably exceeds the melting-point of specular iron, which must always be the case in the preparation of gray cast iron, the tetracarburet formed will be decomposed into octocarburet and carbon, separating in the form of graphite. The melted crude iron arrives in the crucible as octocarburet, and solidifies, after casting, into gray cast iron. By incomplete decomposition of the tetracarburet, mottled cast iron is produced, consisting of a mixture of tetracarburet and octocarburet similar to white cast iron, but distinguishable from this by the particles of graphite disseminated through it.

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* From the Lond. Chem. Gaz., No. 329.

In order to ascertain how far the views expressed above as to the influence exerted by the carburets of iron on the production of pig iron would agree with the results of analysis, the author calculated a series of the most trustworthy analyses of pig iron by Karsten, Berthier, Bodemann, Bromeis, and others. In this calculation, the fundamental principle was adhered to, that all the electro-negative constituents of the cast iron were chemically combined with the electro-positive according to those known compounds in which the maximum of the latter is contained as $(Fe\,Mn)^4P$, $(Fe\,Mn)^8\,S$, and $(Fe\,Mn)^8\,Si$. The only exception being in the case of the specular iron, where, for the sake of analogy with the carburets, a tetrasiliciuret has been assumed.

The following are the results of the calculation :—

I. White Cast Iron.

Specular Iron from Spathose Iron Ore from Saynerhutte. Karsten.

Carbon,	5·112	$Fe^4\,C$	Fe	94·188	99·300
Sulphur,	0·001		C	5·112	
Iron,	94·887	$Fe^8\,S$	Fe	0·014	0·015
Copper,	trace		S	0·001	
	100·000			99 315	

Specular Iron from Lohhutte. Karsten.

Carbon,	5·411	$Fe^4\,C$	Fe	88·099	97·291
Silicium,	0·366		Mn	4·245	
Sulphur,	traces		C	4·947	
Phosphorus,		$Fe^4\,Si$	Fe	1·698	2·064
Iron,	90·797		Si	0·366	
Manganese,	4·245				
Copper,	0·179				
	99·998			99·355	

Specular Iron from Spathose and Brown Iron Ores, Hammhutte. Karsten.

Carbon,	5·140	$(Fe, Mn)^4C$	Fe	89·726	95·606
Sulphur,	0·002		Mn	0·794	
Phosphorus,	0·080		C	5·086	
Silicium,	0·560	$Mn^4\,Si$	Mn	3·130	3·686
Iron,	89·720		Si	0·556	
Manganese,	4·300	$Mn^4\,P$	Mn	0·556	0·636
			P	0·080	
		$Mn^8\,S$	Mn	0·028	0·030
			S	0·002	
	100·002			99·958	

White Cast Iron, Calder Iron Works, England. Berthier.

Carbon,	1·90	$Fe^4 C + Fe^8 C$	Fe	53·750	55·671
Graphite,	0·50		C	1·921	
Sulphur,	1·40	$Fe^8 Si$	Fe	12·108	13·308
Phosphorus,	1·20		Si	1·200	
Silicium,	1·20	$Fe^8 S$	Fe	19·474	20·874
Iron,	93·42		S	1·400	
Manganese,	0·38	$Fe^4 P$	Fe	8·088	9·288
			P	1·200	
		Graphite,			0·500
	100·00				99·641

White Cast Iron, Hammhutte. Berthier.

Carbon,	2·910	$Fe^4 C + 3 Fe^8 C$	Fe	95·202	98·112
Sulphur,	0·010		C	2·910	
Phosphorus,	0·080	$Mn^8 Si$	Mn	0·109	0·110
Silicium,	0·001		Si	0·001	
Iron,	95·202	$Mn^8 S$	Mn	0·140	0·150
Manganese,	0·890		S	0·010	
		$Mn^4 P$	Mn	0·528	0·608
			P	0·080	
	99·093			98·980	

White Cast Iron from Spathose Iron Ore, Magdesprung. Bromeis.

Carbon,	2·52	$Fe^4 C + 6 Fe^8 C$	Fe	88·532	91·052
Graphite,	0·50		C	2·520	
Sulphur,	trace	$Fe^8 Si$	Fe	3·329	3·659
Phosphorus,	0·40		Si	0·330	
Silicium,	0·33	$Mn^4 P$	Mn	3·270	3·670
Iron,	92·06		P	0·400	
Manganese,	3·27	Graphite Copper			0·610
Copper,	0·11				
	99·19				98·991

II. GRAY CAST IRON.

Mottled Cast Iron from Sphærosiderite, Firmy. Berthier.

Carbon,	1·00	$2Fe^4C + Fe^8C$	Fe	24·84	25·84
Graphite,	0·18		C	1·00	
Sulphur,	3·75	$Fe^8 Si$	Fe	13·11	14·41
Phosphorus,	0·38		Si	1·30	
Silicium,	1·30	$Fe^8 S$	Fe	52·36	56·11
Iron,	93·39		S	3·75	
		$Fe^4 P$	Fe	2·56	2·94
			P	0·38	
		Graphite,			0·18
	100·00				99·48

Mottled Cast Iron from Konigshutte, Hartz. Bodemann.

Carbon,	2·78	$Fe^4C + Fe^8C$	Fe	77·562	80·342
Graphite,	1·99		C	2·780	
Phosphorus,	1·23	$Fe^8 Si$	Fe	7·164	7·874
Sulphur,	trace		Si	0·710	
Silicium,	0·71	$Fe^4 P$	Fe	0·290	9·520
Iron,	93·29		P	1·230	
		Graphite,			1·990
	100·00				99·726

Mottled Cast Iron, South Staffordshire. Wrightson.

Carbon,	2·72	$Fe^4C + Fe^8C$	Fe	91·310	94·030
Graphite,	0·26		C	2·720	
Phosphorus,	0·37	$Fe^8 Si$	Fe	1·109	1·219
Sulphur,	trace		Si	0·110	
Silicium,	0·11	$Fe^4 P$	Fe	2·493	2·863
Iron,	95·80		P	0·370	
		Graphite,			0·260
Manganese, Calcium, Sodium,	0·74	Mn Ca Na			0·740
	100·00				99·112

Gray Pig Iron, Konigshutte, Hartz. Bodemann.

Carbon,	1·44	Fe^8C	Fe	53·726	55·166
Graphite,	2·71		C	1·440	
Sulphur,	trace	Fe^8Si	Fe	32·388	35·598
Phosphorus,	1·22		Si	3·210	
Silicium,	3·21	Fe^4P	Fe	8·223	9·443
Iron,	92·42		P	1·220	
		Graphite,			2·710
	101·00				102·917

Gray Cast Iron from Spathose and Brown Iron Ores, Hammhutte. Karsten.

Carbon,	2·08	$(Fe, Mn)^8C$	Fe Mu	78·70	80·78
Graphite,	2·37		C	2·08	
Silicium,	1·31	$Fe^8 Si$	Fe	13·14	14·45
Phosphorus,	0·08		Si	1·31	
Iron,	86·73	$Fe^4 P$	Fe	0·75	0·83
Manganese,	7·42		P	0·08	
		Graphite,			2·37
	99·99				98·43

Gray Iron from Lancashire Hæmatite. Miller.

Carbon,	2·217	$Fe^8 C$	Fe	82·716	84·933
Graphite,	0·538		C	2·217	
Silicium,	0·951	$Fe^8 Si$	Fe	9·595	10·546
Sulphur,	0·150		Si	0·951	
Phosphorus,	trace	$Fe^8 S$	Fe	2·086	2·236
Iron,	95·777		S	0·150	
		Graphite,			0·538
	99·633				98·253

A glance at the interpretation of the above analyses will be sufficient to show the close agreement between the results assuming the hypothesis of the two subcarburets of iron, and to prove the probable correctness of the views on the theory of the production of pig iron above put forth.

Lastly, to exhibit analytically the influence which the different temperatures at which the respective varieties of cast iron are produced exert on their composition, the author undertook a series of analyses of such varieties of pig iron as were produced from the same ores, fluxes, and fuel, but at different degrees of temperature. These were five varieties from the celebrated iron works of Gartsherrie in Scotland, made from black band iron-stone with raw coal and limestone from the coal-measures. Their chemical composition was as follows:—

	1.	2.	3.	4.	5.
Carbon, .	1·347	1·021	1·793	1·925	2·451
Graphite, .	3·156	2·641	1·110	1·051	0·877
Silicium, .	2·721	3·061	2·165	1·895	1·124
Sulphur, .	1·267	1·139	1·480	1·614	2·516
Phosphorus,	0·842	0·928	1·171	1·811	0·913
Iron, . . .	88·983	90·236	89·314	91·368	89·863
Manganese,	2·401	0·834	1·596	0·571	2·715
	100·717	99·860	98·629	100·235	100·459

1. Very gray iron, with graphite in large flakes; spec. grav.= 7·15.
2. Gray iron with much graphite, but in small flakes; spec. grav=7·21.
3. Mottled gray iron; spec. grav. = 7·21.
4. Mottled gray iron; spec. grav.= 7·25.
5. White cast iron, with radiate crystalline fracture; spec. grav.=7·41.

Of these pig irons 1 and 2 were produced at the highest temperature, that is to say, with the largest consumption of fuel, while in the three others it was diminished. The blast had a considerable pressure, and the air was heated above the melting point of lead for the production of the gray pig.

The above analyses plainly show, that with the diminution of the temperature the amount of the graphite and silicium also diminishes, and, on the other hand, that the chemically combined carbon and the sulphur steadily increase, while the amount of phosphorus varies; for the amount of manganese also no law can be discovered. The large amount of sulphur in these Scotch irons is, no doubt, chiefly owing to a considerable quantity of pyrites often disseminated through the coal used as fuel.

The theoretical calculation of the five analyses agrees with the above assumption that the two varieties 1 and 2 are composed of Fe^8 C and the three others of mixtures of Fe^8 C and Fe^4 C, furnishing a new proof of the correctness of the above views on the influence exerted by the carburets of iron on the chemical composition of pig iron.

On the Analysis of Cast Iron.—As the analysis of cast iron is often accompanied with considerable difficulty, and the various methods proposed afford results differing widely from each other, the author gives the following methods made use of by himself, after many comparative trials had convinced him of their advantage and accuracy.

Determination of the Carbon, Graphite, and Silicium.—The substance is placed in a glass flask with about four times its weight of chloride of silver recently precipitated and well washed, a saturated solution of muriate of ammonia poured over it, and allowed to stand ten to twelve days at a moderate temperature. The iron is hereby converted into protochloride and dissolved, but is again decomposed into sesquioxide and sesquichloride by absorption of oxygen. The silicium is oxidized, and the carbon and graphite remain undissolved. When the iron is completely dissolved, the solution is gently boiled with a few drops of hydrochloric acid to redissolve any portions of sesquioxide which may have separated, the contents of the flask are then brought on a filter, and the residue washed first with water, and afterwards with cyanide of potassium, to dissolve any undecomposed chloride of silver; this must be continued until the filtered fluid no longer exhibits the reactions of silver; the washing is then completed with pure water, and the filter dried and weighed; the weight of the silver, graphite, carbon, and silica is thus obtained; a certain portion of this residue is then boiled for some time with a solution of caustic soda; the silica and chemically combined carbon are dissolved and separated from the silver and graphite, which are weighed, and the difference will give the weight of the former substances.

The solution of soda is evaporated to dryness after being acidulated with hydrochloric acid, redissolved and filtered; the carbon and silica remain on the filter, which is burnt: the weight of the silica is thus obtained, that of the carbon being determined by the difference.

To determine the graphite, it is only necessary to dissolve the silver in dilute nitric acid; the graphite remains unaltered and may be weighed.

Determination of the Sulphur.—It is not advisable to determine the sulphur in cast iron by precipitating the sulphuric acid by a salt of baryta from a solution in aqua regia, as it is difficult to avoid a portion of nitrate of baryta accompanying the precipitate, which cannot afterwards be separated by washing. It is better to dissolve about 1 grm. of the iron in dilute sulphuric acid with the assistance of heat, passing the hydrosulphuric acid gas into a moderately dilute solution of acetate of lead. The sulphuret of lead thereby produced is collected on a filter, well washed, converted into sulphate of lead by means of nitric acid, and weighed.

Determination of Iron, Manganese, and Phosphorus.—From a solution of the iron in aqua regia, in which these substances will exist as chloride of iron, protochloride of manganese, and phosphoric acid, the iron is precipitated by the addition of pure dry carbonate of soda in the cold, accompanied by the phosphoric acid as phosphate of iron, while the manganese remains in solution as carbonate of protoxide of manganese dissolved by the excess of carbonic acid. The precipitate is collected without loss of time, and thoroughly washed with cold water; it is ignited and weighed, and gives the amount of iron and phosphoric acid. A weighed portion of this precipitate is fused with four times its weight of a mixture of $3\,NaO\,Co^2 + 2KO\,CO^2$, for twenty to thirty minutes, in a platinum crucible, whereby the phosphoric acid is brought into combination with soda; the fused mass is treated with water and filtered, the solution saturated with pure nitric acid, and boiled some time to expel the whole of the carbonic acid; a few drops of acetic acid and solution of acetate of lead are then added, whereupon phosphate of lead is precipitated, which is washed and ignited; it contains in 100 parts, 8·523 of phosphorus. The manganese is easily obtained from the solution in carbonic acid by the addition of caustic soda or potash; the precipitate, which is white, but gradually becomes brown, is collected, ignited, and weighed as deutoxide.

Determination of Zinc.—In some specimens of cast iron minute quantities of zinc are found, which can only be estimated by a separate experiment. From a solution in aqua regia the iron is precipitated by succinate of soda, afterwards the zinc by carbonate of soda; the manganese remains in solution; the carbonate of zinc is ignited and weighed as oxide of zinc.

Determination of Arsenic and Copper.—Arsenic and copper are precipitated by hydrosulphuric acid from the solution of the iron in aqua regia, separated from each other by sulphide of ammonium, and determined in the usual manner.—*Polytechn. Centralbl.*, 1856, p. 366–379.

"*The Law of the Squares.*"—*Is it Applicable or no, to the Transmission of Signals in Submarine Circuits?*[*] By WILDMAN WHITEHOUSE.

Referring to the proceedings of this section last year at Glasgow, the author quoted Professor W. Thomson's paper on this subject, where he stated "that a part of the theory communicated by himself to the Royal Society last May, and published in the proceedings, shows that a wire of six times the length of the Varna and Balaklava wire, if of the same lateral dimensions, would give thirty-six times the retardation, and thirty-six times the slowness of action. If the distinctness of utterance and rapidity of action, practicable with the Varna and Balaklava wire, are only such as not to be inconvenient, it would be necessary to have a wire of six times the diameter, or better, thirty-six wires of the same dimensions, or a larger number of smaller wires twisted together, under a gutta percha covering, to give tolerably convenient action by a submarine cable of six times the length."

Mr. Whitehouse then stated that circumstances had enabled him to make very recently a long series of experiments upon this point, the result of which he proposed to lay before the section, adding that an opportunity still existed for repeating these experiments upon a portion of cable to which he could obtain access, and that he was ready to show them before a committee of this section in London, if the important nature of the subject should seem to render such a course desirable.

Although the subject of submarine telegraphy had many points of the highest importance requiring investigation, and to the consideration of which he had been devoting himself, the author proposed to confine his remarks on this occasion to the one point indicated in the title—inasmuch as a decision of that one, either favorably or otherwise, would have on the one hand the effect of putting a very narrow limit to our progress of telegraphy, or, on the other, of leaving it the most ample scope. He drew a distinction between the mere transmission of a current across the Atlantic (the possibility of which he supposed everybody must admit), and the effectual working of a telegraph at a speed sufficient for "commercial success," and we gathered from his remarks that there were those ready to embark in the undertaking as soon as the possibility of "commercial success" was demonstrated. He then gave a description of the apparatus employed in his researches, of the manner in which the experiments were conducted, and lastly of the results obtained. The wires upon which the experiments were made were copper of No. 16 gauge, very perfectly insulated with gutta percha, and spun into two cables containing three wires each of equal length (83 miles), covered with iron wires, and coiled in a large tank in full contact with moist earth, but not submerged: the two cables were subsequently joined together, making a length of 166 miles of cable, containing three wires. In addition to this, in some of the latest experiments he had also the advantage of another length of cable, giving with the above an aggregate of 1020 miles.

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[*] From the Lond. Civ. Eng. and Arch's. Jour., Sept., 1856.

The instruments, one of which was exhibited, seemed to be of great delicacy, capable of the utmost nicety of adjustment, and particularly free from sources of error. The records of the amount of retardation were all made automatically by electro-chemical decomposition on chemically prepared paper. The observations of different distances recorded themselves upon the same slip of paper—thus 0·83, and 249 miles were imprinted upon one paper; 0·83, 498 upon another slip; 0·249, 498 upon another; 0·535, 1020 upon another; thus, by the comparison of the several simultaneous records on each slip, as well as by the comparison of one slip with another, the author has been enabled to show most convincingly that the Law of the Squares is not the law which governs the transmission of signals in submarine circuits. The author showed next, by reference to published experiments of Faraday and Wheatstone, ("*Philosophical Magazine*," July, 1855), that the effect of the iron covering with which the cable was surrounded, was, electrically speaking, identical with that which would have resulted from submerging the wire, and that the results of the experiments could not on that point be deemed otherwise than reliable. He next alluded to the objection raised by Prof. Thomson against experiments in "multiple" cables. Faraday, he said, had experimented upon wires laid in close juxta-position, with reliable results (See "Experimental Researches," vol. 3, page 575); but, in addition to this, our author proposed to himself to answer this objection by an appeal to direct experiments. To decide the question, he first weighed the amount of induction produced in one wire during the use of interrupted or alternating currents in an adjacent wire. A current of eighteen thousand grains thrown into one produced in a length of 166 miles, a current of one grain and a-half by induction in the adjacent and parallel wire; in round numbers, one grain in 10,000,—so slight an amount of interference, in fact, that it may be practically disregarded in this investigation. Indeed, it was found impossible to produce any appreciable difference with reference to the retardation by varying the arrangement of the wires, so that at one time they should carry like currents, at another time unlike, as long as the earth remained part of the circuit. But the author was not without the testimony of most competent persons as additional evidence upon this point. Lieutenant Col. Biddulph, director of the Black Sea Telegraph —the very line to which Prof. Thomson refers—happening to be in England at the time of these researches, went through a series of experiments with our author, and gave as his opinion, "that the phenomena of induction and retardation were as marked, and that there was fully as much, if not more, embarrassment of instruments in these 498 miles of cable as he had met with in the Black Sea line." We may take it as proved, therefore, that experiments on such a cable, fairly and continuously conducted, may be regarded as real practical tests, and the results obtained as a fair sample of what will ultimately be found to hold good practically in lines laid out *in extenso.* Attention was then called to a table showing the amount of retardation observed at various distances, and under as nearly similar conditions as was possible to obtain. In this are embodied the results of far more labor than meets the eye. At the head of each column is stated the number of observations upon which the result given was computed, every observation being rejected on which there could fall a suspicion of carelessness, inaccuracy, or uncertainty as to the precise conditions; and on the other hand, every one which was retained being carefully measured to the 100th part of a second.

This table is subject to correction for variation in the state of the battery employed just as barometrical observations are subject to correction for temperature. "Of this variation, as a source of error," said our author, "I am quite aware, but I am not yet in possession of facts enough to supply me with the exact amount of correction required. I prefer, therefore, to let the results stand without correction. Now it needs not long examination of this table to find that we have the retardation following an increasing ratio, that increase being very little beyond the simple arithmetical ratio.

"I am quite prepared to admit the possibility of an amount of error having crept in these figures in spite of all precautions. Indeed, I have, on that account, been anxious to multiply observations, in order to obtain trustworthy results; but I cannot admit the possibility of error having accumulated to such an extent as to entirely overlay and conceal the operation of the law of the squares, if, in reality, that law had any bearing on the results. Taking 83 miles as our unit of distance, we have a series of 1, 2, 3, 6, and 12. Taking 166 miles as our unit, we have then a series of 1, 3, and 6. Taking 249 miles, we have still a series of 1, 2, and 4, in very long distances. Yet, even under these circumstances, and with these facilities, I cannot find a trace of the operation of that law."

Table of Retardation observed at Various Distances.

Voltaic Current.—Time stated in parts of a second.

Mean of 550 observations.	Mean of 110 observations.	Mean of 1840 observations.	Mean of 1960 observations.	Mean of 120 simultaneous observations.	
83 miles	166 miles	249 miles	498 miles	535 miles	1020 miles.
·08	·14	·36	·79	·74	1·42

The author then examined the law of the squares, as shown by the value of a current taken in submarine or subterranean wires, at different distances from the generator thereof.

Magneto-electro currents were weighed at Liverpool, which had traveled respectively 40, 120, 240, and 320 miles—from Manchester, Birmingham, London, and Belfast. The results did not confirm the laws of the squares, and the most distant come out with less loss than a comparison of the shorter lengths had led him to anticipate. Another result was even more striking. The voltaic current from a battery of very moderate power, weighed at a distance of 498 miles, in the cable before mentioned, 250 grains on its exit from the wire to earth. Divide the cable into six lengths, and, in accordance with the law of the squares, at some part of the first length this current ought to be found weighing 36 times 250=9000 grains. This is nearly half as much again as the current actually did weigh at 83 miles, and nearly 1500 grains more than the same current (by observations both at the beginning and end of the experiment,) gave as its maximum lift on short circuit. These observations, by weight, though not possessing, if taken by themselves, the full force which would be due to them had the subject of loss by traveling, and the ratio thereof, been fairly worked out, are yet strongly corroborative of the general results.

"Intimately connected with the consideration of this subject," said our author, "is another which is so closely related to it as to be almost a necessary and integral part thereof. I mean the question of the *size of the conducting wire.* I venture to allude to it now (even though from its importance a subject of special research with me at this moment, and my series of experiments on this point, still in progress and far from complete), because it may be regarded as an appeal to another court for a decision upon the same question put in a different form. The number of wires in the cable enabled me to determine the relative degrees of retardation observable when using a single, double, or treble-sized conductor of the same length in each instance—viz : 166 miles. I had thus to a limited degree the opportunity of testing the application of this law as enunciated by Prof. W. Thomson last year, with reference to the size of conductor necessary, to which I have already alluded. The results, far from confirming the law, are strikingly opposed to it. The fact of trebling the size of the conductor augmented the amount of retardation so as to nearly double that observed in the single wire. I give the actual figures obtained as the mean of one series of thirty-two observations on the point:

Amount of retardation taken at 166 miles:—

Voltaic Current.—Time stated in parts of a second.

Size of conductor.	Mean of 32 observations,
Single,	·15
Double,	·20
Treble,	·17

Velocity as deduced from the foregoing—

Single wire and earth,	1100 miles per second.
Double " "	830 " "
Treble " "	614 " "

These observations were taken again and again with extreme care, were repeated on several days, and with uniformly corresponding results."

The author then stated that the most searching and most practical test, in fact the *experimentum crucis*, would be found in the limit of the rapidity and distinctness of utterance attainable at different distances. He laid before the Section records taken at 498 and 1020 miles. These being taken by the same instrument, and under like conditions, may be regarded as perfectly reliable for comparison with each other, though from being taken with the magneto-electric, instead of voltaic current, and recorded by a new form of instrument, they are not comparable with results obtained by any of the ordinary form of telegraphic instrument. Three hundred and fifty was the highest number of distinct signals recorded in the minute through 498 miles, and two hundred and seventy through 1020 miles, the former being at the rate of nearly six in the second, the latter four and a half in the second. These figures bear no relation to the squares of the distance—they are even far beyond the simple arithmetical ratio.

"Now, if the law of the squares be held good in its application to submarine circuits, and if the deduction as to the necessary size of the wire based upon that law can be proved to be valid also, we are driven to the inevitable conclusion that submarine cable of certain length, to be successful, must be constructed in accordance with these principles; and what does this involve? In the case of the transatlantic line, whose estimated length will be no less than 2500 miles, it would necessitate the use, for a single conducting wire only, of a cable so large and ponderous as that probably no ship, except Scott Russell's leviathan, could carry it; so unwieldy in the manufacture, that its perfect insulation would be a matter almost of practical impossibility; and so expensive, from the amount of materials employed, and the very laborious and critical nature of the processes required in making and laying it out, that the thing would be abandoned as being practically and commercially impossible. It has been calculated by one intimately connected with this branch of manufacture, and to whom the art of submarine telegraphy owes much of its success, that the first cost of the copper wire alone for a single conductor of such a size would exceed the entire cost of an electric cable containing three circuits of the ordinary gauge; while the amount of money and time involved in making and insulating one of the large size perfectly, is, he says, impossible to arrive at.

"If, on the other hand, the law of the squares be proved to be inapplicable to submarine wires, whether with reference to the amount of retardation observable in them, the rapidity of utterance to be obtained, or the size of the conductor required for the purpose, then we may shortly expect to see a cable not much exceeding one ton per mile, containing three, four, or five conductors, stretched from shore to shore, and uniting us to our transatlantic brethren, at an expense of less than one-fourth that of the large one above mentioned, able to carry from four to five times the number of messages, and therefore yielding about twenty times as much return in proportion to the outlay. And what, it may be asked, is the general conclusion to be drawn as the result of this investigation of the law of the squares applied to submarine circuits? In all honesty, I am bound to answer, that I believe nature knows no such application of that law; and I can only regard it as a fiction of the schools, a forced and violent adaptation of a principle in physics, good and true under other circumstances, but misapplied here."

*German Telegraphs.**

Experience shows that low prices induce the general use of telegraphs. According to official returns published at Berlin the Prussian telegraphs, which in 1852 did not cover their expenses by 79,831 dollars, had a surplus revenue in 1855 of 101,431 dollars, and the estimates for 1856 figure in the budget for no less than 202,467 dollars. On the 1st of January, 1856, there were in the States comprising the "German and Austrian Telegraph Union," 234 stations, with 11,585 miles of telegraphs opened. Of these, Austria has 69 stations, with 4755 miles; Prussia, 67 stations, with 4575 miles; Bavaria, 32 stations, with 1305 miles; Hanover, 19 stations, with 710 miles; Saxony, 9 stations, with 410 miles; Baden, 7 stations, with 360 miles; Wurtemburg, 5 stations, with 225 miles; Mecklenburg-Schwerin, 5 stations, with 110 miles; and Holland, which has joined the union, 19 stations, with 710 miles.

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* From the Lond. Athenæum, August, 1856.

For the Journal of the Franklin Institute.

Particulars of the Steam Dredger General Moultrie.

Hull built by William Colyer, New York. Machinery by C. H. Delamater, New York. Intended service, Charleston Bar.

Hull.—

Length on deck from fore part of stem to after part of stern post above the spar deck,		150 feet.
Breadth of beam at midship section above the main wales,		26 " 8 inches.
Depth of hold,		10 " 3 "
Draft of water at deep load line,		8 "
" " below pressure and revolutions,		8 "
Area of immersed midship section at this draft,		244 sq. feet.
Tonnage,	365.	

Engine.—Vertical direct—non-condensing.

Diameter of cylinder,		26 inches.
Length of stroke,		2 feet. 2 "
Maximum pressure of steam in pounds,	60.	
Maximum revolutions per minute,	50.	

Boilers.—Two—Cylindrical flued.

Length of boilers,		25 feet.
Diameter, "		4 "
Number of furnaces,	one.	
Length of grate bars,		5 "
Number of flues,	two in each.	
Internal diameter of flues,		15 inches.
Length of flues,		25 "
Heating surface,		675 sq. feet.
Diameter of smoke pipe,		2 feet 6 "
Height " "		24 "
Description of coal,	Bituminous.	

Propellers.—

Diameter of screw,		9 feet.
Pitch of screw,		13 "
Number of blades,	4.	

Remarks.—Floor timber, at throat, *molded* 14 ins., *sided* 6 ins. Distance of frames apart *at centres* 26 ins. Well in centre, 45 × 16 at top, and 45 × 7 at bottom. Machinery for dredging to be fitted at Charleston.

C. H. H.

*Railway Sleepers.**

Dr. Boucherie, of Paris, states, in reference to the subject,— that:

" The *Times* of the 19th of August gives an account of an experiment, according to my processes for preserving timber, made by the engineers of the Permanent Way Company. This article has called forth from Mr. Bethell, of London, a reply, inserted in the *Times* of the 22d ultimo. I cannot better repel the accusation of plagiarism which Mr. Bethell therein brings against me than by sending to England two official patents which may be seen at the office of the Permanent Way Company, and which have been given me by the French Government, in compliance with two applications for the same which I addressed to it. The first, the 11th of December, 1837, is for the process which I have pointed out, by means of which divers preservative substances are made to penetrate the tissues of wood, employing for that purpose that natural upward force by which the sap is rapidly transferred from the root to the top of the largest trees. Thus a tree of any size was, after being cut down, plunged at its lower end into a tub containing the liquid with which it was to be penetrated. Having found sundry inconveniences in this method of injection, my labors led me to discover a new mode, which I have described on the 30th of May, 1838, applying at the same time for an additional patent. This system consisted in placing one of the ends of a tree in a bag of water-proof cloth, firmly attached to its circumference, which bag communicated with a reservoir containing the liquid. Since then I have considerably modified my plans of operation, and these have been the subject of several subsequent patents. On the 10th of July, 1838 (that is to say, seven months after my first patent, and 42 days after the second), Mr. J. Bethell took out a patent in England for the preservation of wood. In his specification three plans are described. 1. The making the preserving liquid penetrate by capillary attraction,—the natural method described in my patent of the 11th of December, 1837. 2. Penetration by capping with an india-rubber bag communicating with a reservoir,—the mode pointed out in my additional patent of the 30th of May, 1838. 3. Penetration by mechanical vacuum and pressure,—a system the priority of which can be easily claimed by M. Bréant. I leave others to judge to whom belongs the title of inventor. It is true that in 1840 my processes were patented in England in the name of a London merchant, but I do not think that any one is authorized to assume the title of inventor by the single fact that he may have been more in haste than the inventor was to patent in a foreign land the object of his invention, especially when his birth place is only separated by an interval which a few hours suffice to pass over. It does not belong to me to eulogise my discovery; I shall confine myself to saying that it has gained for me at all the French Exhibitions the first gold medals; at the London Exhibition the same reward as was given to Mr. Bethell; and at the Universal Exhibition at Paris one of the four great medals of honor; further, by a special law, unprecedented in France, an extension has been granted to my patent. All my labors and numerous experiments have proved to me that, in proportion as the preservation of the timber takes place before the drying up of the sap in the fibres, it is the more complete if the sap is expelled, to make way for preservative substances.

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*From the Lond. Journ. of the Society of Arts, No. 198.

"It is, then, important to subject timber, within two or three months after felling, to that preparation which gives it durability, the limits of which have not yet been found.

"The difficulty in using my process in England is not so great as Mr. Bethell is pleased to represent. Nothing is easier than to have the timber prepared in the midst of the forests which supply the markets of Britain, it is a problem most easy to solve, if but the appeal be made to the fertile intelligence of English industrialists."

For the Journal of the Franklin Institute.

Trigonometrical Developments, and Integration of Trigonometrical Functions. By John M. Richardson.

In mechanical investigations, differential relations, involving trigonometrical expressions, are of frequent occurrence. The integration of these may often be facilitated by using tables of the powers of sines and cosines. Having derived considerable advantage from the use of such tables myself, I venture to offer them to others with the hope that they may prove of general benefit. The method of calculation is also given in order that if any errors occur in transcribing or printing, they may be detected.

For the general process, I am indebted to Boucharlat and De Morgan. (See Boucharlat's Elements de Calcul Differentiel et Integral, and De Morgan's Calculus.)

According to Euler,

$$\left.\begin{array}{l} \cos x + \sin x \sqrt{-1} = e^{x\sqrt{-1}} \\ \cos x - \sin x \sqrt{-1} = e^{-x\sqrt{-1}} \end{array}\right\} \quad . \quad . \quad . \quad (1)$$

Equations (1) being true for all values of x, are true when x becomes $m\,x$. Hence,

$$\left.\begin{array}{l} \cos m\,x + \sin m\,x \sqrt{-1} = e^{m\,x\sqrt{-1}} \\ \cos m\,x - \sin m\,x \sqrt{-1} = e^{-m\,x\sqrt{-1}} \end{array}\right\} \quad . \quad . \quad . \quad (2)$$

Raising equations (1) to the *m*th power,

$$\left.\begin{array}{l} (\cos x + \sin x \sqrt{-1})^{m} = e^{m\,x\sqrt{-1}} \\ (\cos x - \sin x \sqrt{-1})^{m} = e^{-m\,x\sqrt{-1}} \end{array}\right\} \quad . \quad . \quad (3)$$

Comparing (1), (2), (3), there result:

$$\left.\begin{array}{l} \cos m\,x + \sin m\,x \sqrt{-1} = (\cos x + \sin x \sqrt{-1})^{m} \\ \cos m\,x - \sin m\,x \sqrt{-1} = (\cos x - \sin x \sqrt{-1})^{m} \end{array}\right\} \quad (4)$$

Adding equations (1) together, and putting $e^{x\sqrt{-1}}$ and $e^{-x\sqrt{-1}}$ equal to u and v respectively,

$$\cos x = 2^{-1}(u+v) = 2^{-1}(v+u) \quad . \quad . \quad . \quad (5)$$

Raising (5) to the mth power.

$$\left.\begin{aligned} \cos^{m} x &= 2^{-m}\left[u^{m} + m\,u^{m-1} v + 2^{-1} m\,(m-1)\,u^{m-2} v^{2} + \&c.\right] \\ \cos^{m} x &= 2^{-m}\left[u^{m} + m\,v^{m-1} u + 2^{-1} m\,(m-1)\,v^{m-2} u^{2} + \&c.\right] \end{aligned}\right\} \quad (6)$$

Adding equations (6),

$$2^{m+1} \cos^{m} x = u^{m} + v^{m} + m\,(u^{m-1} v + v^{m-1} u) + 2^{-11} m\,(m-1)\,(u^{m-2} v^{2} + v^{m-2} u^{2}) + \&c. \text{ or}$$

$$2^{m+1} \cos^{m} x = u^{m} + v^{m} + m\,u\,v\,(u^{m-2} + v^{m-2}) + 2^{-1} m\,(m-1)\,u^{2} v^{2}\,(u^{m-4} + v^{m-4}) + \&c. \quad (7)$$

But, since $u = e^{x\sqrt{-1}}$ and $v = e^{-x\sqrt{-1}}$

$$\left.\begin{aligned} u^{m} &= (\cos x + \sin x\,\sqrt{-1})^{m} = \cos m\,x + \sin m\,x\,\sqrt{-1} \\ v^{m} &= (\cos x - \sin x\,\sqrt{-1})^{m} = \cos m\,x - \sin m\,x\,\sqrt{-1} \end{aligned}\right\} \quad . \quad (8)$$

$$u^{m} + v^{m} = 2 \cos m\,x\,;\quad u^{m} v^{m} = 1 \quad . \quad (9)$$

Similarly,

$$\left.\begin{aligned} u^{m-2} + v^{m-2} &= 2 \cos (m-2)\,x\,; & u^{m-2}\,v^{m-2} &= 1 \\ u^{m-4} + v^{m-4} &= 2 \cos (m-4)\,x\,; & u^{m-4}\,v^{m-4} &= 1 \\ \&c. \qquad & \qquad \&c. & \&c. \quad & \end{aligned}\right\} \quad . \quad . \quad (10)$$

Substituting in (7) it becomes,

$$\left.\begin{aligned} \cos^{m} x = 2^{-(m+1)} \Big[& 2 \cos m\,x + 2\,m \cos (m-2)\,x + m\,(m-1) \\ & \cos (m-4)\,x + 3^{-1} m\,(m-1)\,(m-2) \cos (m-6)\,x + \&c. \Big] \end{aligned}\right\} \quad (11)$$

This development contains $(m+1)$ terms, and if $m=2, 3, 4, 5,$ &c., a table of the powers of the cosine of x will be obtained.

Subtracting the last of equations (1) from the first,

$$\sin x = (2\,\sqrt{-1})^{-1}\,(u-v) \quad (12)$$

Raising (12) to the power m,

$$\sin^{m} x = (2\,\sqrt{-1})^{-m}\,(u-v)^{m} \quad (13)$$

If m is even, $(u-v)^{m} = (v-u)^{m}$ or

$$\sin^{m} x = (2\,\sqrt{-1})^{-m}\,(u-v)^{m} = (2\,\sqrt{-1})^{-m}\,(v-u)^{m} \quad (14)$$

Developing and proceeding as above,

$$\left.\begin{aligned}\sin^m x = (2\sqrt{-1})^{-m}\Big[\cos m x - m\cos(m-2)\,x + 2^{-1} m\,(m-1)\\ \cos(m-4)\,x - 6^{-1} m\,(m-1)\,(m-2)\cos(m-6)\,x + \&c.\Big]\end{aligned}\right\} \tag{15}$$

m being even, the imaginary quantity will disappear.

If m is odd $(u-v)^m = -(v-u)^m$ and,

$$\sin^m x = (2\sqrt{-1})^{-m}(u-v)^m = -(2\sqrt{-1})^{-m}(v-u)^m \tag{16}$$

Hence,

$$2\sin^m x = (2\sqrt{-1})^{-m}\Big[u^m - v^m - m\,u\,v\,(u^{m-2} - v^{m-2}) + \&c.\Big] \tag{17}$$

From (10),

$$u^m - v^m = 2\sin m x\sqrt{-1};\ u^m v^m = 1;\ \&c. \tag{18}$$

Therefore (17) becomes,

$$\left.\begin{aligned}\sin^m x = 2^{-1}(2\sqrt{-1})^{-m+1}\Big[\sin m x - m\sin(m-2)\,x +\\ 2^{-1} m\,(m-1)\sin(m-4)\,x - 6^{-1} m\,(m-1)\,(m-2)\sin(m-6)x + \&c.\Big]\end{aligned}\right\} \tag{19}$$

Since m is odd, $m-1$ is even, and the imaginary quantity will disappear.

It must be recollected that,

$$\cos(+x) = \cos(-x);\ \sin(-x) = -\sin(+x)\quad . \tag{20}$$

When m is negative a different process has to be adopted. Since, $\sin^2 x + \cos^2 x = 1$, $\sin^{-m} x$ and $\cos^{-m} x$ may be multiplied by any power of $\sin^2 x + \cos^2 x$, without having their values affected. Hence,

$$\left.\begin{aligned}\sin^{-m} x = \sin^{-m} x\,(\sin^2 x + \cos^2 x)^{\frac{m}{2}} = 1 + 2^{-1} m\cot^2 x + 2^{-3} m\,(m-2)\\ \cot^4 x + \&c.\\ \sin^{-m} x = \sin^{-m} x\,(\sin^2 x + \cos^2 x)^{\frac{m+2}{2}} = \sin x + 2^{-1}(m+1)\cos x\cot x\\ + 2^{-3}(m+1)\,(m-1)\cos x\cot^3 x + \&c.\end{aligned}\right\} \tag{21}$$

The first or second of (21) is used according as m is even or odd.

$$\left.\begin{aligned}\cos^{-m} x = \cos^{-m} x\,(\cos^2 x + \sin^2 x)^{\frac{m}{2}} = 1 + 2^{-1} m\tan^2 x + 2^{-3} m\,(m-2)\\ \cot^4 x + \&c.\\ \cos^{-m} x = \cos^{-m} x\,(\cos^2 x + \sin^2)^{\frac{m+1}{2}} = \cos x + 2^{-1}(m+1)\sin x\tan x\\ + 2^{-3}(m+1)\,(m-1)\sin x\tan^3 x + \&c.\end{aligned}\right\} \tag{22}$$

The first or second of (22) is used according as m is even or odd.

It is evident that any number of different forms of expansion may be obtained for the same negative power of $\sin x$ or $\cos x$.

It is sometimes more advantageous to have the integral of various expressions in certain forms rather than in others, and, I propose, therefore, to investigate a number of trigonometrical functions, and to give several different expressions for the same integral.

Required the integral of $\sin^m x\, dx$.

CASE I. When m is whole, even, positive.

(1.) Expand $\sin^m x$ by (15), and the integral will be obtained in terms of the sines of multiple arcs.

(2.) $\sin^m x\, dx = \cos x \sin^m x\, (1-\sin^2 x)^{-\frac{1}{2}}\, dx.$ . . . (23)

Applying the formula for integrating by parts,

$$\int \sin^m x\, dx = m^{-1}\left[\sin^{m-1} x \cos x - (m-1)\int \sin^{m-2} x\, dx\right] \quad . \quad . \quad (24)$$

By repeated application, of (24), the integral will be made to depend upon $\int dx = x$.

(3.) Assume $\cot x = z$; then,

$$\int \sin^m x\, dx = -\int (z^2+1)^{-\frac{m+2}{2}}\, dz. \quad . \quad . \quad . \quad (25)$$

CASE II. When m is whole, odd, positive.

(1.) Expand $\sin^m x$ according to (19); the integral will then be obtained in terms of the cosines of multiple arcs.

(2.) Let $\cos x = z$; then,

$$\int \sin^m x\, dx = -\int \sin^{m-1} x\, d(\cos x) = -\int (1-z^2)^{\frac{m-1}{2}}\, dz. \quad . \quad . \quad (26)$$

(3.) $$\left.\begin{aligned}\int \sin^m x\, dx = \int \cos x\, (1-\sin^2 x)^{-\frac{1}{2}}\, dx = m^{-1}\Big[\sin^{m-1} x \cos x \\ -(m-1)\int \sin^{m-2} x\, dx\Big]\end{aligned}\right\} (27)$$

By repeated application of (27), the final integral will depend upon $\int \sin x\, dx = -\cos x$.

CASE III. When m is whole, even, negative.

(1.) Expanding according to the first of (21), it is seen that the final integral will depend upon that of $\cot x\, dx$.

Let $\cot x = z$; then,

$$\left.\begin{aligned}\int \cot^m x\, dx = -\int z^m (1+z^2)^{-1}\, dz = -(m-1)^{-1}\Big[z^{m-1} - (m-1) \\ \int z^{m-2} (1+z^2)^{-1}\, dz\Big]\end{aligned}\right\} (28)$$

The final integral will depend upon $\int(1+z^2)^{-1}dz=\tan^{-1}z$.

(2.) Let $\operatorname{cosec} x=z$; then,

$$\left.\begin{aligned}\int\sin^{-m}x\,dx=\int\operatorname{cosec}^{m}x\,dx=-\int z^{m-3}(z^2-1)^{-\frac{1}{2}}dz=-(m-3)^{-1}\\ \left[z^{m-4}+(m-4)\int z^{m-5}(z^2-1)^{-\frac{1}{2}}dz\right]\end{aligned}\right\}\quad(29)$$

Repeated applications of this formula, will cause the final integral to depend upon $\int z(z^2-1)^{-\frac{1}{2}}dz=(z^2-1)^{\frac{1}{2}}$.

(3.) $$\sin^{-m'}x\,dx=\sin x\sin^{-(m'+1)}x\,dx.$$

Let $\sin x\,dx=dv$; $\sin^{-(m'+1)}x=u$; $\therefore v=-\cos x$; $d\,u=-(m'+1)\cos x\sin^{-(m'+2)}x\,dx$.

Applying the formula for integrating by parts.

$$\int\sin^{-m'}x\,dx=-\cos x\sin^{-(m'+1)}x-(m'+1)\int\cos^2x\sin^{-(m'+2)}x\,dx.$$

$$\int\sin^{-(m'+2)}x\,dx=-(m'+1)^{-1}\left[\cos x\sin^{-(m'+1)}x-m'\int\sin^{-m'}x\,dx.\right]$$

If $m'+2=m$, then $m'+1=m-1$, and $m'=m$ —.

$$\int\sin^{-m}x\,dx=-(m-1)^{-1}\left[\cos x\sin^{-m+1}x-(m-2)\int\sin^{-m+2}x\,dx.\right]\quad(30)$$

CASE IV. When m is entire, odd, negative.

(1.) Expanding $\sin^{-m}x$ according to the second of (21), it is evident, that the integral of $\sin^{-m}x\,dx$ depends upon that of $\cos x\cot^{m}x\,dx$.

$$\int\cos x\cot^{m}x\,dx=\int\cos^{m+1}x\sin^{-m}x\,dx=\int\sin x\cos^{m+1}x\sin^{-(m+}x\,dx$$

$$=-\int\cos^{m+1}x\sin^{-(m+1)}x\,d(\cos x)\text{ and,}$$

$$\int\cos x\cot^{m}x\,dx=-\int z^{m+1}(1-z^2)^{-\frac{-(m+1)}{2}}dz.\quad.\quad(31)$$

Where $\cos x=z$.

(2.) $\int\sin^{-m}x\,dx=\int\sin x\sin^{-(m+1)}x\,dx=\int-\sin^{-(m+1)}x\,d(\cos x)=-$

$$\int(1-z^2)^{-\frac{-(m+1)}{2}}dz.\quad.\quad.\quad.\quad.\quad.\quad.\quad(32)$$

$\cos x=z$.

(3.) The integral of $\sin^{-m}x\,dx$, as in (3) of the preceding case, may be obtained by using formula (30). Repeated applications of (30) will cause the final integral to depend upon $\int(\sin x)^{-1}dx$ $\int(\sin x)^{-1}dx=$

$$\int\sin x(1-\cos^2x)^{-1}dx=2^{-1}\log(1-\cos x)(1+\cos x)^{-1}=\log\tan 2^{-1}x.\ (33)$$

CASE V. When m is fractional and positive.

$$\text{Let } m = r\,s^{-1}. \quad \sin x = \sin^{s} z \text{ then}$$

$$\int \sin^{rs-1} x\,d\,x = s\int \cos z\,(1-\sin^{2s} z)^{-\frac{1}{2}} \sin^{r+s-1} z\;d\,z = s\int (1-\sin^{2s} z)^{-\frac{1}{2}} \sin^{r+s-1} z\,d(\sin z)$$

$$\int \sin^{rs-1} x\,d\,x = s\int (1-u^{2s})^{-\frac{1}{2}}\,u^{r+s-1}\,d\,u. \quad . \quad . \quad . \quad . \qquad (34)$$

Where $u = \sin z$.

CASE VI. When m is fractional and negative.

$$\text{Let } m = -r\,s^{-1} \quad \sin x = \sin^{s} z$$

$$\int \sin^{-rs-1} x\,d\,x = s\int \sin^{-r+s-1} z\,(1-\sin^{2s} z)^{-\frac{1}{2}}\,d(\sin z) = s\int u^{-r+s-1}\,(1-u)^{2s-\frac{1}{2}}\,d\,u \qquad (35)$$

$$u = \sin z.$$

Since $\cos x = \sin(2^{-1}\pi - x) = \sin x'$, $\cos^{m} x\;d\,x$ is always integrable whatever may be the sign or value of m provided $\sin^{m} x$ is integrable.

$$\int \cos^{m} x\,d\,x = -\int \text{sim}^{m} x'\,d\,x' \quad . \quad . \quad . \qquad (36)$$

Required the integral of $\sin x^{m} \cos^{n} x\;d\,x$.

CASE I. When m and n are entire, even positive.

(1.) If $m = n$.

$$\int \sin^{m} x \cos^{n} x\,d\,x = \int \sin^{m} x\;\cos^{m} x\;d\,x = 2^{-m}\int \sin^{m} 2\,x\;d\,x \quad . \qquad (37)$$

(2.) If $m > n$

$$\int \sin^{m} x \cos^{n} x\,d\,x = \int \sin^{m-n} x\;\sin^{n} x \cos^{n} x\,d\,x = 2^{-n}\int \sin^{m-n} x \sin^{n} 2\,x\,d\,x$$

$$\int \sin^{m} x \cos^{n} x\,d\,x = 2^{-\frac{(m+n)}{2}}\int (1-\cos 2\,x)^{\frac{m-n}{2}} \sin^{n} 2\,x\,d\,x \quad . \qquad (38)$$

Repeated applications of this formula will complete the integration.

(3.) If $m < n$

$$\int \sin^{m} x\;\cos^{n} x\,d\,x = 2^{-\frac{m+n}{2}}\int (1+\cos 2\,x)^{\frac{n-m}{2}} \sin^{m} 2\,x\,d\,x \qquad (39)$$

(4.) $$\int \sin^{m} x \cos^{n} x\,d\,x = \int \sin^{m-1} x \cos^{n} x \sin x\,d\,x.$$

$$\text{Let } \sin x \cos^{n} x\,d\,x = d\,v\,;\ \sin^{m-1} x = u\,;\ \therefore\ v = -(n+1)^{-1} \cos^{n+1} x;$$

$$d\,u = (m-1)\sin^{m-2} x \cos x\;d\,x.$$

Applying the formula for integrating by parts.

$$\int \sin^{m} x \cos^{n} x\,d\,x = -(m+n)^{-1}\Big[\sin^{m-1} x \cos^{n+1} x - (m-1)\int \sin^{m-2} x \cos^{n} x\,d\,x\Big] \quad (40)$$

Repeated applications of this formula will cause the final integral to depend upon that of $\cos^n x\,dx$; which has been provided for.

(5.) $$\int \sin^m x \cos^n x\,dx = \int \sin^m x \cos^{n-1} x \cos x\,dx.$$

Let $\sin^m x \cos x\,dx = dv$; $\cos^{n-1} x = u$; $\therefore v = (m+1)^{-1} \sin^{m+1} x$

$$du = -(n-1) \cos^{n-2} x \sin x\,dx.$$

Applying the formula $\int u\,dv = uv - v\,du$.

$$\int \sin^m x \cos^n x\,dx = (m+n)^{-1} \left[\sin^{m+1} x \cos^{n-1} x + (n-1) \int \sin^m x \cos^{n-2} x\,dx \right] \quad (41)$$

Hence $\int \sin^m x \cos^n x\,dx$ will depend upon $\int \sin^m x\,dx$; which has been provided for.

Case II. When m and n are whole, odd, positive.

(1.) $$\int \sin^m x \cos^n x\,dx = \int \sin^m x \cos^{n-1} x \cos x\,dx = \int \sin^m x \cos^{n-1} x\,d(\sin x)$$

Let $\sin x = z$; then

$$\int \sin^m x \cos^n x\,dx = \int z^m (1-z^2)^{\frac{n-1}{2}}\,dz. \quad . \quad . \quad (42)$$

(2.) $$\int \sin^m x \cos^n x\,dx = \int \sin^{m-1} x \cos^n x \sin x\,dx = -\int \sin^{m-1} x \cos^n x\,d(\cos x)$$

Let $\cos x = z$, then

$$\int \sin^m x \cos^n x\,dx = -\int z^n (1-z^2)^{\frac{m-1}{2}}\,dz. \quad . \quad (43)$$

(3.) If $m = n$.

$$\int \sin^m x \cos^n x\,dx = \int \sin^m x \cos^m x\,dx = 2^{-m} \int \sin^m 2x\,dx. \quad (44)$$

(40) & (41) can be employed in this case.

Case III. When m is even and n odd; both positive.

Apply (40), or (41), or (42),

Case IV. When m is odd and n even; both positive.

Apply (40), or (41), or (43).

Case V. When m and n are whole, even, negative.

(1.) If $m = n$,

$$\int \sin^{-m} x \cos^{-n} x\,dx = \int \sin^{-m} x \cos^{-m} x\,dx = 2^m \int \sin^{-m} 2x\,dx \quad (45)$$

(2.) If $m > n$, since $\sin^2 x + \cos^2 x = 1$.

$$\left.\begin{array}{l}\int \sin^{-m} x \cos^{-n} x \, d x = \int \sin^{-m} x \cos^{-n} x \left(\sin^2 x + \cos^2 x\right)^{\frac{m}{2}} d x = \\ \int \Big[\cos^{-n} x + 2^{-1} m \cos^{-n+2} x \sin^{-2} x + 2^{-3} m (m-2) \cos^{-n+4} x \sin^{-4} x + \&c., \\ + 2^{-1} m \cos^{m-n-2} x \sin^{-m+2} x + \cos^{m-n} x \sin^{-m} x\Big] dx \quad . \quad . \end{array}\right\} \quad (46)$$

The first term of this development can be integrated by preceding formulas; and by treating each of the other terms in the same manner, the integral will finally be obtained.

(3.) If $m < n$,

$$\left.\begin{array}{l}\int \sin^{-m} x \cos^{-n} x \, d x = \int \sin^{-m} x \cos^{-n} x \, d x \left(\cos^2 x + \sin^2 x\right)^{\frac{n}{2}} = \\ \int \Big[\sin^{-m} x + 2^{-1} n \sin^{-(m-2)} x \cos^{-2} x + \&c., + 2^{-1} n \sin^{+(n-m-2)} x \cos^{-(n-2)} x + \sin^{-(m-n)} x \cos^{-n} x\Big] dx \end{array}\right\} (47)$$

Case VI. When m and n are whole, odd, negative.

(1.) If $m = n$,

$$\int \sin^{-m} x \cos^{-n} x \, d x = \int \sin^{-m} x \cos^{-m} x \, d x = 2^{m} \int \sin^{-m} (2 x) \, d x \qquad (48)$$

(2.) If $m > n$,

$$\int \sin^{-m} x \cos^{-n} x \, d x = \int \sin^{-(m-n)} x \sin^{-n} x \cos^{-n} x \, d x = 2^{n} \int \sin^{-(m-n)} x \sin^{-n} 2 x \, d x$$

$$= 2^{\frac{m+n}{2}} \int (1 - \cos 2 x)^{\frac{-m-n}{2}} \sin^{-n} 2 x \, d x = 2^{\frac{m+n}{2}} \int (1 - \cos 2 x)^{-\frac{-m-n}{2}} \sin^{-(n+1)} 2 x$$

$$\sin 2 x \, d x = -2^{\frac{m+n-2}{2}} \int (1 - \cos 2 x)^{-\frac{m-n}{2}} \sin^{-(n+1)} 2 x \, d (\cos 2 x).$$ Hence

$$\left.\begin{array}{l}\int \sin^{-m} x \cos^{-n} x \, d x = -2^{\frac{m+n-2}{2}} \int (1 - z)^{-\frac{m-n}{2}} (1 - z^2)^{-\frac{n+1}{2}} d z = \\ -2^{\frac{m+n-2}{2}} \int (1 - z)^{-\frac{m-n}{2}} (1 - z)^{-\frac{n+1}{2}} d z = -2^{\frac{m+n-2}{2}} \int (1 - z) \\ ^{\frac{-m+1}{2}} (1 + z)^{\frac{-n-1}{2}} d z \end{array}\right\} \quad (49)$$

Where $z = \cos 2 x$.

$$\left.\begin{array}{l}\int \sin^{-m} x \cos^{-n} x \, d x = \int \sin^{-m} x \cos^{-n} x \left(\sin^2 x + \cos^2 x\right)^{\frac{m+1}{2}} d x = \\ \int \Big[\sin x \cos^{-n} x + 2^{-1} (m+1) (\sin x)^{-1} \cos^{-(n-2)} x + \&c., + 2^{-1} (m+1) \\ \sin^{-(m-2)} x \cos^{(m-n-1)} x + \sin^{-m} x \cos^{(m+1-n)} x\Big] d x. \end{array}\right\} \quad (50)$$

(3.) If $m < n$

$$\int \sin^{-m} x \cos^{-n} x \, dx = -2^{\frac{m+n-2}{2}} \int (1+z)^{-\frac{n+1}{2}} (1+z)^{-\frac{m+1}{2}} \, dz \qquad (51)$$

Where $z = \cos 2x$.

$$\left.\begin{aligned} &\int \sin^{-m} x \cos^{-n} x \, dx = \int \Big[\cos x \sin^{-m} x + 2^{-1}(n+1)(\cos x)^{-1} \sin^{-(m-2)} x + \\ &\&c., +2^{-1}(n+1) \cos^{-(n-2)} x \sin^{(n-m-1)} x + \cos^{-n} x \sin^{(n+1-m)} x \Big] dx \end{aligned}\right\} \qquad (52)$$

CASE VII. When m is whole, even, positive; n is whole, even, negative.

(1.) If $m = n$;

$$\left.\begin{aligned} &\int \sin^{m} x \cos^{-n} x \, dx = \int \tan^{m} x \, dx = \int (1-\cos^2 x)^{\frac{m}{2}} \cos^{-m} x \, dx = \\ &\int \Big[\cos^{-m} x - 2^{-1} m \cos^{-(m-2)} x + 2^{-3} m (m-2) \cos^{-(m-4)} x - -\&c., \mp \\ &2^{-1} m \cos^{-2} x \pm 1 \Big] dx \end{aligned}\right\} \qquad (53)$$

(2.) If $m > n$;

$$\left.\begin{aligned} &\int \sin^{m} x \cos^{-n} x \, dx = \int (1-\cos^2 x)^{\frac{m}{2}} \cos^{-n} x \, dx = \int \Big[\cos^{-n} x - 2^{-1} m \\ &\cos^{-(n-2)} x + \&c., + 2^{-1} m \cos^{(m-n-2)} x \mp \cos^{m-n} x \Big] dx \end{aligned}\right\} \qquad (54)$$

(3.) If $m < n$;

$$\left.\begin{aligned} &\int \sin^{m} x \cos^{-n} x \, dx = \int \sin^{-(n-m)} x \sin^{n} x \cos^{-n} x \, dx = \int \sin^{-(n-m)} x \\ &\Big[\cos^{-n} x - 2n^{-1} \cos^{-(n-2)} x + \&c., \mp 2^{-1} n \cos^{-2} x \pm 1 \Big] dx \end{aligned}\right\} \qquad (55)$$

(4.) According to (40).

$$\int \sin^{m} x \cos^{-n} x \, dx = -(m-n)^{-1} \Big[\sin^{m-1} x \cos^{-(n-1)} x - (m-1) \int \sin^{m-2} x \cos^{-n} x \, dx \Big] \qquad (56)$$

CASE VIII. When m is whole, odd, positive; n whole, even, negative.

$$\left.\begin{aligned} &(1) \int \sin^{m} x \cos^{-n} x \, dx = -(m-n)^{-1} \Big[\sin^{m-1} x \cos^{-(n-1)} x - (m-1) \\ &\int \sin^{m-2} x \cos^{-n} x \, dx \Big] \end{aligned}\right\} \qquad (57)$$

$$\left.\begin{aligned} &(2) \int \sin^{m} x \cos^{-n} x \, dx = -\int \sin^{m-1} x \cos^{-n} x \, d(\cos x) = -\int (1-z^2)^{\frac{m-1}{2}} \\ &\qquad z^{-n} \, dz \int \sin^{m} x \cos^{-n} x \, dx = -\int \Big[z^{-n} - 2^{-1} (m-1) z^{-(n-2)} + \&c., \\ &2^{-1} (m-1) z^{m-n-3} \pm z^{m-n-1} \Big] dz \end{aligned}\right\} \qquad (58)$$

Where $z = \cos x$.

Case IX. When m is whole, odd, positive; n is whole, odd, negative.

(1.) If $m \gtreqless n$;

$$\int \sin^{m} x \cos^{-n} x \, d\, x = -\int \sin^{m-1} x \cos^{-n} x \, d\,(\cos x). \quad \text{Hence}$$

$$\int \sin^{-m} x \cos^{-n} x \, d\, x = -\int \left[1-z^2\right]^{\frac{m-1}{2}} z^{-n} \, d\, z \qquad (59)$$

(2.) Apply (40).

Case X. When m is whole, even, positive; n is whole, odd, negative.

(1.) If $m \lessgtr n$;

$$\int \sin^{m} x \cos^{-n} x \, d\, x = \int \sin^{m} x \cos^{-(n+1)} x \cos x \, d\, x = \int \sin^{m} x \cos^{-(n+1)} x \, d\,(\sin x)$$

$$\int \sin^{m} x \cos^{-n} x \, d\, x = \int z^{m} (1-z^2)^{\frac{-(n+1)}{2}} \, d z \qquad (60)$$

(2.) Apply (40).

Case XI. When m whole, even, negative; n is whole, even, positive.

(1.) Since $\sin x = \cos(2^{-1} \pi - x) = \cos x'$; $\cos x = \sin(2^{-1} \pi - x) =$ $\sin x'$, $\int \sin^{-m} x \cos^{n} x \, d\, x = -\int \cos^{-m} x' \sin^{n} x' \, d\, x'$ (61)

This has been provided for (Case VII).

Case XII. When m whole, even, negative; n is whole, odd, positive.

(1.) $\int \sin^{-m} x \cos^{n} x \, d\, x = -\int \cos^{-m} x \cos^{n} x' \, d\, x'$ (62)

Where $x' = 2^{-1} \pi - x$. Provided for (See Case VIII).

Case XIII. When m is whole, odd, negative; n whole, even, positive.

(1.) $\int \sin^{-m} x \cos^{n} x \, d\, x = -\int \cos^{-m} x' \sin^{n} x' \, d\, x'$ (63)

Provided for (Case X.)

Case XIV. When m is whole, odd, negative; n whole, odd, positive.

(1.) $\int \sin^{-m} x \cos^{n} x \, d\, x = -\int \cos^{-m} x' \sin^{n} x' \, d\, x'$ (64)

Already provided for (See Case IX).

Case XV. When m and n are fractional.

Let $m = r s^{-1}$; $n = p q^{-1}$ and $\sin x = \sin^{s} z$. Then,

$$\sin^{rs-1} x = \sin^{r} z;\ \cos^{pq-1} = (1-\sin^{2s} z)^{\frac{p}{2q}};\ d\, x = s \sin^{s-1} z\, (1-\sin^{2s} z)^{-\frac{1}{2}} \times (1-\sin^{2} z)^{\frac{1}{2}} d z \qquad (65)$$

$$\int \sin^{rs^{-1}} x \cos^{pq^{-1}} x \, d\, x = s \int \sin^{r+s-1} z\, (1-\sin^{2s} z)^{\frac{p-q}{q}} (1-\sin^2 z)^{\frac{1}{2}} d z \qquad (66)$$

Let $\sin z = u$; then $dz = (1 - \sin^2 z)^{-1/2}\, du$. Substituting in (66)

$$\int \sin^{rs^{-1}} x \cos^{pq^{-1}} x\, dx = s \int u^{r+s-1} (1 - u^{2s})^{\frac{p-q}{2q}}\, du \tag{67}$$

Table of powers of Sines with positive exponents.

$\sin x = -2^{-1} (\cos 2x - 1)$.

$\sin^3 x = -2^{-2} (\sin 3x - 3 \sin x)$.

$\sin^4 x = 2^{-3} (\cos 4x - 4 \cos 2x + 3)$.

$\sin_5 x = 2^{-4} (\sin 5x - 5 \sin 3x + 10 \sin x)$.

$\sin^6 x = -2^{-5} (\cos 6x - 6 \cos 4x + 15 \cos 2x - 10)$.

$\sin^7 x = -2^{-6} (\sin 7x - 7 \sin 5x + 21 \sin 3x - 35 \sin x)$.

$\sin^8 x = 2^{-7} (\cos 8x - 8 \cos 6x + 28 \cos 4x - 56 \cos 2x + 35)$.

$\sin^9 x = 2^{-8} (\sin 9x - 9 \sin 7x + 36 \sin 5x - 84 \sin 3x + 126 \sin x)$

$\sin^{10} x = -2^{-9} (\cos 10x - 10 \cos 8x + 45 \cos 6x - 120 \cos 4x +$
$210 \cos 2x - 126)$.

Table of powers of Sines with negative exponents.

$\sin^{-2} x = 1 + \cot^2 x$.

$\sin^{-3} x = \sin x + 2 \cos x \cot x + \cos x \cot^3 x$.

$\sin^{-4} x = 1 + 2 \cot^2 x + \cot^4 x$.

$\sin^{-5} x = \sin x + 3 \cos x \cot x + 3 \cos x \cot^3 x + \cot^5 x$.

$\sin^{-6} x = 1 + 3 \cot^2 x + 3 \cot^4 x + \cot^6 x$.

$\sin^{-7} x = \sin x + 4 \cos x \cot x + 6 \cos x \cot^3 x + 4 \cos x \cot^5 x + \cos x \cot^7 x$.

$\sin^{-8} x = 1 + 4 \cot^2 x + 6 \cot^4 x + 4 \cot^6 x + \cot^8 x$.

$\sin^{-9} x = \sin x + 5 \cos x \cot x + 10 \cos x \cot_3 x + 10 \cos x \cot^5 x + 5 \cos x$
$\cot^7 x + \cos x \cot^9 x$.

$\sin^{-10} x = 1 + 5 \cot^2 x + 10 \cot^4 x + 10 \cot^6 x + 5 \cot_8 x + \cot^{10} x$.

Table of the powers of Cosines with positive exponents.

$\cos^2 x = 2^{-1} (\cos 2x + 1)$.

$\cos^3 x = 2^{-2} (\cos 3x + 3 \cos x)$.

$\cos^4 x = 2^{-3} (\cos 4x + 4 \cos 2x + 3)$.

$\cos^5 x = 2^{-4}(\cos 5x + 5\cos 3x + 10\cos x).$

$\cos^6 x = 2^{-5}(\cos 6x + 6\cos 4x + 15\cos 2x + 10).$

$\cos^7 x = 2^{-6}(\cos 7x + 7\cos 5x + 21\cos 3x + 35\cos x).$

$\cos^8 x = 2^{-7}(\cos 8x + 8\cos 6x + 28\cos 4x + 56\cos 2x + 35).$

$\cos^9 x = 2^{-8}(\cos 9x + 9\cos 7x + 36\cos 5x + 84\cos 3x + 126\cos x).$

$\cos^{10} x = 2^{-9}(\cos 10x + 10\cos 8x + 45\cos 6x + 120\cos 4x + 210\cos 2x + 126).$

Table of the powers of Cosines with negative exponents.

$\cos^{-2} x = 1 + \tan^2 x.$

$\cos^{-3} x = \cos x + 2\sin x\tan x + \sin x\tan^3 x.$

$\cos^{-4} x = 1 + 2\tan^2 x + \tan^4 x.$

$\cos^{-5} x = \cos x + 3\sin x\tan x + 3\sin x\tan^3 x + \sin x\tan_5 x.$

$\cos^{-6} x = 1 + 3\tan^2 x + 3\tan^4 x + \tan^6 x.$

$\cos^{-7} x = \cos x + 4\sin x\tan x + 6\sin x\tan^3 x + 4\sin x\tan^5 x + \sin x\tan^7 x.$

$\cos^{-8} x = 1 + 4\tan^2 x + 6\tan^4 x + 4\tan^6 x + \tan^8 x.$

$\cos^{-9} x = \cos x + 5\sin x\tan x + 10\sin x\tan^3 x + 10\sin x\tan^5 x + 5\sin x\tan^7 x + \sin x\tan^9 x.$

$\cos^{-10} x = 1 + 5\tan^2 x + 10\tan^4 x + 10\tan^6 x + 5\tan^8 x + \tan^{10} x.$

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*On the Solubility of Bones in Water.** By Prof. Wöhler.

When bone-dust, such as is commonly employed as manure, is left for some time in contact with water, and the latter is filtered away, it is found to contain appreciable quantities of the phosphates of lime and magnesia. The same result is obtained when the water is freed from carbonic acid by long boiling. By filtering water for months through the same mass of bone-dust, it was found constantly to contain these earthy phosphates, and their quantity even appeared to increase in proportion as the organic matter of the bones became putrid in consequence of its long contact with water and air, and the water flowing off became turbid and offensive. This fact seems to have some practical value in agriculture, as it shows that without any artificial preparation the earthy phosphates may be extracted from the bones and introduced into the soil in a state of solution, perhaps exactly in the quantity necessary for their appointed functions, and that in the employment of bone-dust as manure, all the preparation necessary is perhaps to lay it in heaps during the summer, and keep it constantly moist.—*Liebig's Annalen*, April, 1856, p. 143.

* From the Lond. Chem. Gaz., No. 327.

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